California Energy Commission

CALCARS: THE CALIFORNIA CONVENTIONAL AND ALTERNATIVE FUEL RESPONSE SIMULATOR

A Nested Multinomial Logit Vehicle Demand and Choice Model

by

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LEGAL NOTICE

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BACKGROUND

On January 1 ,1992, legislation under the auspices of Senate Bill 1214 took effect in California, adding to the state's Public Resources Code certain transportation energy related provisions. Support for this legislation owed to a large degree to the Persian Gulf War in 1991, which raised fears that the California's heavy dependence on petroleum based fuels made the state's economy (as well as its environment) vulnerable. With this in mind, the legislation calls for an analysis by the California Energy Commission of strategies to reduce petroleum dependence in California. Senate Bill 1214 also calls for an analysis of measures to reduce the social costs (e.g., pollution, congestion) of transportation in the state.

A strategy that has been long been advocated in California as a way of both reducing both petroleum dependence and the social costs of transportation is the promotion of alternative fuels and alternative fuel vehicles. CALCARS, the model described in this paper, was estimated to predict the potential demand for alternative fuel vehicles in California, under a variety of different scenarios. In addition, CALCARS allows an analysis of other measures designed to reduce the social costs of transportation, such as fuel and VMT taxes and accelerated vehicle retirement (scrappage) programs.

INTRODUCTION

The California Light Duty Vehicle Conventional and Alternative Fuel Response Simulator (CALCARS) is a personal light-duty vehicle forecasting methodology currently used by the California Energy Commission (CEC) that projects number and type of vehicles owned, along with annual vehicle miles traveled (VMT) and fuel consumption by personal cars and light-duty trucks, in California. Patterned after the Personal Vehicle Model[1] (PVM), developed in 1983 by Kenneth Train for the CEC, CALCARS uses a nested multinomial logit structure for vehicle ownership and choice. Unlike the PVM and other vehicle choice models however, CALCARS combines stated and revealed preference data in order to forecast the penetration and use of both conventional and alternative fuel vehicles (AFVs). Coefficients for vehicle characteristics such as range, fuel availability, and emissions are estimated simultaneously with "conventional" characteristics such as operating cost and vehicle price in the vehicle choice portions of CALCARS. Vehicle choice is then calibrated to actual ownership choice to estimate vehicle type dummy constants. In the VMT submodel estimation, the stated effects of range and fuel availability on travel are combined with data on the use of currently held vehicles.

In addition, CALCARS simulates explicitly vehicle replacement.[2] This feature makes CALCARS a step in the evolution of vehicle choice demand models, a "dynamic" vehicle holdings model. Because of these improvements, CALCARS is capable of a wider scope of policy analysis. For example, the former enhancement allows analysis of the potential for natural gas vehicles, while the latter gives the capability of studying the effects of vehicle scrappage programs. At the same time, CALCARS is capable of projecting the effects of fuel taxes, feebate programs, and other policies that have been analyzed in the past using holdings models. However, as it has been estimated on California data, CALCARS is more limited in geographic coverage than the PVM, which was estimated on nationwide data. Nevertheless, since California is seen as a leader in the promotion of alternative fuels, CALCARS should be an important tool.

This paper is organized as follows. Section I gives a description of the input data, Section II gives an overview of the structure of the model, Section III describes the methodology of the model, and Section IV gives the estimation results for the various submodels. Section VI presents various forecasts using CALCARS.

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[1] This model, as used by the Department of Energy and the Environmental Protection Agency, among others, is known as the Consumer Automotive Response System (CARS). See Train (1986) for a description of the PVM.

[2] In the PVM, a "transactions cost dummy" is used rather than a full transactions submodel.

I. THE DATA

Estimation of the model was based on survey data collected in 1993 for the Institute of Transportation Studies at the University of California (Davis and Irvine campuses). This survey is part of an ongoing effort by the Institute in the development of the Transactions/Activity Mobility Simulator (TAMOS) for the CEC. TAMOS will combine a vehicle transactions model with an activity-based travel demand simulator. Expected to be ready for use in early 1997, TAMOS should be the most sophisticated model of its kind.

An initial sample of 7,000 households was selected from throughout California, 4,747 of which comprise the final survey sample. The survey consisted of three parts: socio-demographic information, holding and usage information for current vehicles owned, and future vehicle choice and utilization.

In the stated preference vehicle choice portion, each respondent was given two sets of six hypothetical vehicles to choose from, where the choice set included vehicles fueled by gasoline, methanol (M85), compressed natural gas (CNG), and electricity. Each hypothetical vehicle was defined in terms of attributes manipulated according to an experimental design. Vehicle attributes included:

- acceleration (0-30 mph);
- top speed in mph;
- tailpipe emissions (relative to a 1993 gasoline vehicle);
- dual fuel capability (gasoline and alternative fuel);
- service station fuel availability (relative to gasoline);
- home refueling or recharging capability;
- luggage space (relative to a similar gasoline car or truck);
- fuel operating cost (cents per mile);
- price;
- range on a full tank or charge in miles;
- time in minutes required to refuel at home for vehicles with home refueling or recharging capability;
- time in minutes required to refuel or recharge at a service station;
- body style/size.

Respondents were also asked when and how they expected to change their current vehicle stock (either by replacing a vehicle, getting rid of a vehicle without replacement, or adding to current stock). Those households expecting to replace a vehicle or add to their current stock were also asked whether the replacement or added vehicle would be new or used, and the former were asked which vehicle would be replaced.

II. MODEL STRUCTURE

CALCARS uses a nested multinomial logit framework to simulate vehicle ownership decisions. As in the PVM, each household chooses the number of vehicles that will be held in a given time period (zero, one, or two vehicles[3]) along with the class/vintage choice or choice combination.[4] In any time period, CALCARS simulates for each household this decision process *conditional on the previous year's holdings*. Figure 1 on the next page shows the possible paths that each household can take from one time period to the next.

Vehicle choice and quantity decisions are simulated in the model using representative utility.[5] Each vehicle or combination of two vehicles is assigned a utility based on household- and vehicle-specific characteristics. Similarly, the number of vehicles owned (zero, one, or two) is assigned a utility based on household characteristics. In addition, vehicle choices and characteristics influence vehicle quantity through a feedback variable referred to as inclusive value (McFadden, 1978) or expected maximum utility (Ben-Akiva and Lerman, 1991). Section IV provides specifics for this value.

In the PVM, these utilities are used to estimate the probability of owning a particular choice in the following manner. Given the following definitions:

$P_{k,t}$ = the probability of owning only vehicle k in time period t;
$P_{k,l,t}$ = the probability of owning vehicles k and l in time period t;
$U_{k,t}$ = the representative utility of owning only vehicle k in time period t;
$U_{k,l,t}$ = the representative utility of owning vehicles k and l in time period t;
$U0CAR_t$ = the representative utility of owning zero vehicles in time period t (set equal to zero);
$U1CAR_t$ = the representative utility of owning one vehicle in time period t;
$U2CAR_t$ = the representative utility of owning two vehicles in time period t; and
$P0CAR_t$ = the probability of owning zero vehicles in time period t,

we have, for a given household,

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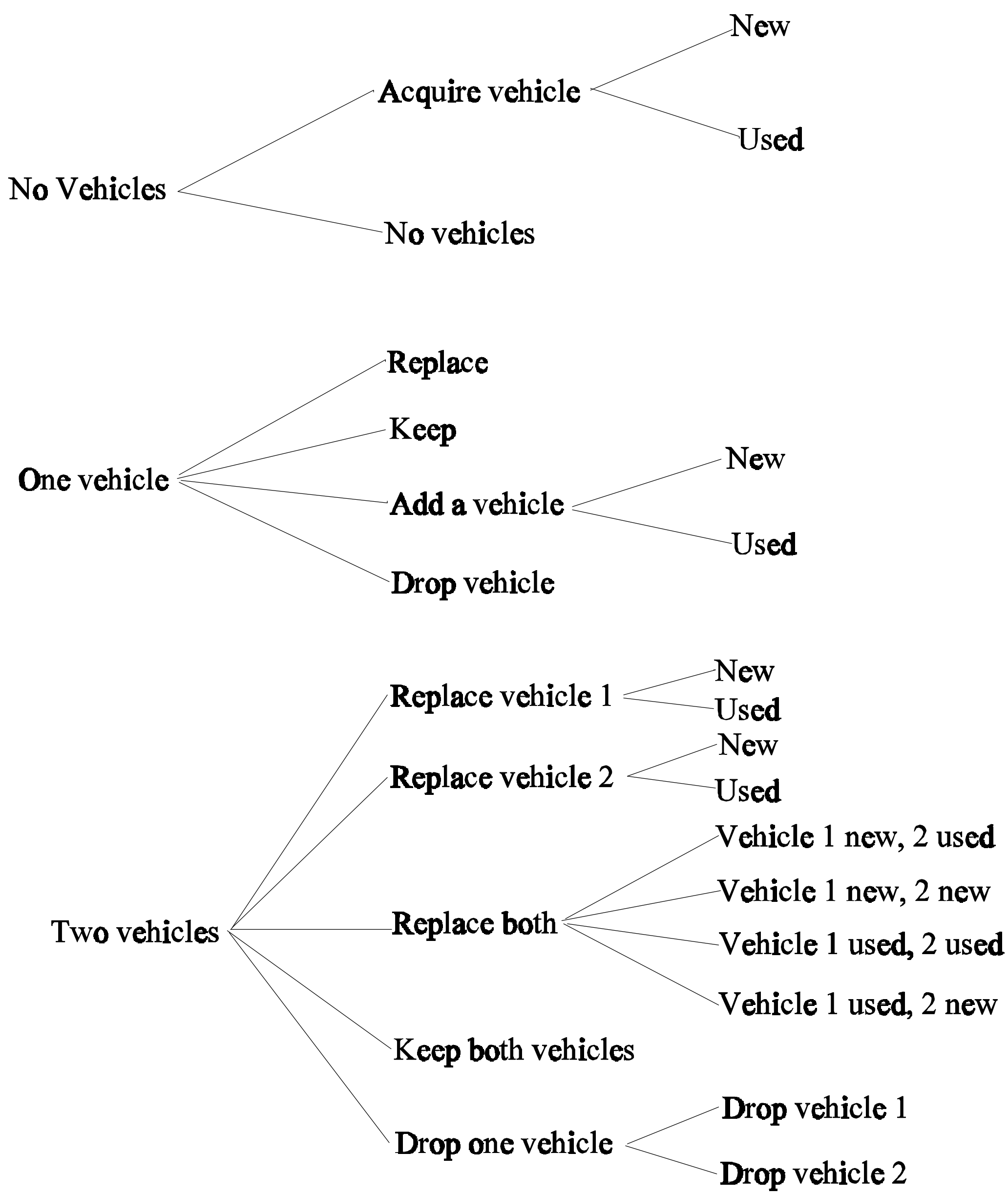
[3] The two vehicle submodel is intended to represent the preferences of households with two or more vehicles. Including a three or four vehicle submodel would make the run time of CALCARS prohibitively high.

[4] Currently, CALCARS is set up to forecast for a maximum of 35 classes (14 gasoline, 5 flexible-fuel methanol, 10 natural gas, and 6 electric) and 17 vintages.

[5] See Train (1986) for a good discussion of representative utility.

Figure 1: Schematic of Vehicle Holdings Through Time

Time *t*-1 | Time *t* | *Vehicle Replacement and Quantity Submodels* | *New/Used and Vehicle Choice Submodels*



$$P_{k,t} = \frac{e^{U1CAR_t}}{e^{U0CAR_t}+e^{U1CAR_t}+e^{U2CAR_t}} \times \frac{e^{U_{k,t}}}{\sum_{i=1}^{n} e^{U_{i,t}}}, \tag{1}$$

$$P_{k,l,t} = \frac{e^{U2CAR_t}}{e^{U0CAR_t}+e^{U1CAR_t}+e^{U2CAR_t}} \times \frac{e^{U_{k,l,t}}}{\sum_{i=1}^{n}\sum_{j=1}^{n} e^{U_{i,j,t}}}, \tag{2}$$

and

$$P0CAR_t = \frac{e^{U0CAR_t}}{e^{U0CAR_t}+e^{U1CAR_t}+e^{U2CAR_t}}. \tag{3}$$

In other words, the probability of choosing only vehicle *k* is the product of the probabilities of owning one vehicle times the probability of choosing vehicle *k* within the set of all one-vehicle choices, and similarly for the two-vehicle choice of types *k* and *l*.

Although this framework is part of CALCARS, the probabilities for choosing an individual vehicle or set of vehicles become much more complex due to the explicit simulation of vehicle replacement and the choice of new versus used vehicles, as presented in the next section.

III. METHODOLOGY OF CALCARS

Unlike other vehicle holdings models, the probabilities for owning a particular vehicle or set of vehicles depend on the vehicle fleet of the previous year. The remainder of this section provides the details for one- and two-vehicle households.

One-Vehicle Case

The probability of owning vehicle *k* in the current time period (and only vehicle *k*) by a given household is a function of the following:

(a) the probability that vehicle *k* only was owned last year and the probability that vehicle *k* is not replaced this year;

(b) the probability that another vehicle was owned last year and the probability that this vehicle is replaced this year and the replacement vehicle is of type *k*;

(c) the probability that zero vehicles were owned last year and the probability that the household acquires a vehicle this year and that vehicle is of type *k*;

(d) the probability that vehicle k is not sold or scrapped with no replacement this year;

(e) the probability that two vehicles were owned last year, one was sold or scrapped and not replaced, and the remaining vehicle is of type k;

(f) the probability that vehicle k was owned last year and an additional vehicle is not added this year.

Given the following definitions:

$P_{i,t}$ = the probability of owning vehicle i (and only i) in time period t;
$P_{i,j,t}$ = the probability of owning vehicle i AND vehicle j in time period t;
PR_i = the probability that vehicle i is replaced in time period t, a function of vehicle and household characteristics (see Section IV);
PRN = the probability of choosing a new vehicle given that a household is replacing and/or adding a vehicle, a function of household income (see Section IV);
$U_{i,t}$ = the utility of owning vehicle i (and only i)in time period t, a function of demographic and vehicle-specific characteristics (see Section IV);
$P0CAR_t$ = the probability of owning zero vehicles in time period t;
$P1CAR_t$ = the probability of owning one vehicle in time period t; and
$P2CAR_t$ = the probability of owning two vehicles in time period t,

these effects can be written algebraically, with the equation captions below corresponding to (a) - (f) above. For vehicle k, we have:

$$P_{k,t-1} \times (1 - PR_k) \,. \qquad \textbf{(a)}$$

(b) depends on whether vehicle k is new or used this period:

$$\sum_{i \neq k} P_{i,t-1} \times PR_i \times \frac{e^{U^{k,t}}}{\sum_{j \neq i,\, j \in used} e^{U_{j,t}}} \times (1 - PRN) \,, \qquad \textbf{(b-1)}$$

if k is a used vehicle, and,

$$\sum_{i \neq k} P_{i,t-1} \times PR_i \times \frac{e^{U^{k,t}}}{\sum_{j,\, j \in new} e^{U_{j,t}}} \times PRN \qquad \textbf{(b-2)}$$

if k is new. Similarly, (c) depends on new/used status:

$$P0CAR_{t\text{-}1}\times\frac{(P0CAR_{t\text{-}1}\text{-}P0CAR_{t})}{P0CAR_{t\text{-}1}}\times\frac{e^{U_{k,t}}}{\sum_{i,i\in used}e^{U_{i,t}}}\times(1\text{-}PRN)\ , \tag{c-1}$$

if k is used, and

$$P0CAR_{t\text{-}1}\times\frac{(P0CAR_{t\text{-}1}\text{-}P0CAR_{t})}{P0CAR_{t\text{-}1}}\times\frac{e^{U_{k,t}}}{\sum_{i,i\in new}e^{U_{i,t}}}\times PRN \tag{c-2}$$

if k is new. Intuitively, (c-1) and (c-2) take the probability that last year's zero vehicle owner becomes a one vehicle owner this period and condition it on the probability of owning zero vehicles last period. (d) accounts for the probability that one vehicle owners last period do not become zero vehicle owners:

$$1\text{-}\frac{(P0CAR_{t}\text{-}P0CAR_{t\text{-}1})}{P1CAR_{t\text{-}1}}\ . \tag{d}$$

(e) is determined by:

$$\sum_{i,i\in used}P_{i,k,t\text{-}1}\times\frac{e^{U_{k,t}}}{(e^{U_{i,t}}+e^{U_{k,t}})}\times\frac{(P2CAR_{t\text{-}1}\text{-}P2CAR_{t})}{P2CAR_{t\text{-}1}}\ . \tag{e}$$

That is, the probability that a two vehicle owner last period becomes a one vehicle owner (third term) is multiplied by the desirability of vehicle k relative to vehicle i (second term) and conditioned by the probability that vehicles i and k were owned last period (first term). Finally, similar to (d), (f) is given as:

$$1\text{-}\frac{(P2CAR_{t}\text{-}P2CAR_{t\text{-}1})}{P1CAR_{t\text{-}1}}\ . \tag{f}$$

The specific form that P_i will take depends on the probabilities of owning zero, one, and two vehicle this year relative to last. For example, if the probabilities of owning one and two vehicles rise relative to last period for a household (say from an increase in income), we have:

$$P_{k,t}=[((a)+(b))\times(f)]+(c)\ , \tag{4}$$

while a drop in the probabilities of owning one and two vehicles relative to last period (for example, from a sharp increase in fuel prices) gives:

$$P_{k,t} = [((a)+(b))\times(d)]+(e)\,. \qquad \mathbf{(5)}$$

In the first case, the probability that the household owned one vehicle last year and ended up with vehicle *k* this year, conditioned on the probability that the household did not become a two-vehicle owner, (f), is added to the probability that the household owned no vehicles last year and acquired choice *k* this year. In the second case, the probability that the household owned one vehicle last year and ended up with vehicle *k* this year is conditioned on the probability that the household did not become a zero vehicle owner this year and added to the probability that a two-vehicle household last period owned choice *k* and got rid of the other vehicle without replacement. This structure assumes that a zero vehicle owner cannot become a two-vehicle household, and that a two-vehicle household cannot become a zero-vehicle owner in one time period, which does not appear to be an unreasonable assumption.[6]

Two-Vehicle Case

The probability of owning vehicles *k* and *l* in the current time period by a given household is a function of the following:

(g) the probability that vehicles *k* and *l* were owned last year and the probability that these vehicles are not replaced this year;

(h) the probability that one of these two vehicles was owned last year and the probability that the other vehicle is replaced this year and the replacement vehicle is *k* or *l*, whichever was not owned last year;

(i) the probability that neither vehicle *k* nor vehicle *l* was owned last year, both of last period's vehicles are replaced this year, and that type *k* and type *l* are chosen

(j) the probability that neither vehicle *k* nor vehicle *l* is sold or scrapped without replacement this year;

(k) the probability that one vehicle was owned last year and that vehicle was of type *k* or *l*, the probability that a second vehicle is added this year, and that vehicle is of type *k* if type *l* was owned last year or of type *l* if type *k* was owned last year.

Using the same definitions as in the one vehicle case along with the following:

[6] The Wave 1 sample showed no instances where this had occurred in a one-year time frame.

$U_{i,j,t}$ = the utility of owning vehicle i and vehicle j in time period t, a function of demographic and vehicle specific characteristics (see Section IV),

(g) - (k) can be written algebraically. (g) is given as:

$$\boldsymbol{P}_{k,l,t\text{-}1}\times(1\text{-}\boldsymbol{PR}_k)\times(1\text{-}\boldsymbol{PR}_l)\,. \tag{g}$$

(h) depends on whether vehicle k and/or vehicle l are new or used in the current period. For example, if k was owned last year, l was not, and l is used, we have:

$$\sum_{\boldsymbol{i}\neq l}\boldsymbol{P}_{k,\boldsymbol{i},t\text{-}1}\times(1\text{-}\boldsymbol{PR}_k)\times\boldsymbol{PR}_{\boldsymbol{i}}\times\frac{e^{U_{k,l,t}}}{\sum_{\boldsymbol{j}\in\boldsymbol{used},\boldsymbol{j}\neq\boldsymbol{i}}e^{U_{k,\boldsymbol{j},t}}}\times(1\text{-}\boldsymbol{PRN})\,, \tag{h-1}$$

while if l is new we have:

$$\sum_{\boldsymbol{i}}\boldsymbol{P}_{k,\boldsymbol{i},t\text{-}1}\times(1\text{-}\boldsymbol{PR}_k)\times\boldsymbol{PR}_{\boldsymbol{i}}\times\frac{e^{U_{k,l,t}}}{\sum_{\boldsymbol{j}\in\boldsymbol{new}}e^{U_{k,\boldsymbol{j},t}}}\times\boldsymbol{PRN}. \tag{h-2}$$

(i) also depends in new/used status. For example if k and l are both used in the current period, we can write:

$$\sum_{\boldsymbol{i},\boldsymbol{i}\neq k,l}\sum_{\boldsymbol{j},\boldsymbol{j}\neq k,l}\boldsymbol{P}_{\boldsymbol{i},\boldsymbol{j},t\text{-}1}\times\boldsymbol{PR}_{\boldsymbol{i}}\times\boldsymbol{PR}_{\boldsymbol{j}}\times\frac{e^{U_{k,l,t}}}{\sum_{m,m\in\boldsymbol{used},m\neq\boldsymbol{i},\boldsymbol{j}}\sum_{n,n\in\boldsymbol{used},n\neq\boldsymbol{i},\boldsymbol{j}}e^{U_{m,n,t}}}\times$$

$$(1\text{-}\boldsymbol{PRN})\times(1\text{-}\boldsymbol{PRN})\,, \tag{i-1}$$

while if k is used and l is new, we have:

$$\sum_{\boldsymbol{i},\boldsymbol{i}\neq k}\sum_{\boldsymbol{j},\boldsymbol{j}\neq k}\boldsymbol{P}_{\boldsymbol{i},\boldsymbol{j},t\text{-}1}\times\boldsymbol{PR}_{\boldsymbol{i}}\times\boldsymbol{PR}_{\boldsymbol{j}}\times\frac{e^{U_{k,l,t}}}{\sum_{m,m\in\boldsymbol{used},m\neq\boldsymbol{i},\boldsymbol{j}}\sum_{n,n\in\boldsymbol{new},}e^{U_{m,n,t}}}\times$$

$$(1\text{-}\boldsymbol{PRN})\times\boldsymbol{PRN}. \tag{i-2}$$

Given that vehicles *k* and *l* were owned last year, (j) can be written as:

$$1-\frac{(P2CAR_{t-1}-P2CAR_t)}{P2CAR_{t-1}}. \qquad \textbf{(j)}$$

Finally, (k) accounts for one vehicle owners last period becoming two vehicle owners. Assuming vehicle *k* was owned last year and that vehicle *l* is used, we have:

$$P_{k,t-1}\times\frac{(P2CAR_t-P2CAR_{t-1})}{P1CAR_{t-1}}\times\frac{e^{U_{k,l,t}}}{\sum_{i\in used}e^{u_{k,i,t}}}\times(1-PRN), \qquad \textbf{(k-1)}$$

whereas if *l* is new:

$$P_{k,t-1}\times\frac{(P2CAR_t-P2CAR_{t-1})}{P1CAR_{t-1}}\times\frac{e^{U_{k,l,t}}}{\sum_{i\in new}e^{u_{k,i,t}}}\times PRN. \qquad \textbf{(k-2)}$$

As in the one vehicle case, the exact probability calculation depends on the probabilities of owning one and two vehicles this period relative to last. If the probability of two vehicles rises this year, the calculation is given by:

$$(g)+(h)+(i)+(k), \qquad \textbf{(6)}$$

while a drop in the probability of owning two vehicles means that the calculation becomes:

$$[(g)+(h)+(i)]\times(j). \qquad \textbf{(7)}$$

In (6), the probability of ending up with choices *k* and *l* this year given that the household owned two vehicles last period is added to the probability that a one-vehicle owner last period that owned vehicle *k* adds choice *l* this year. In (7), the probability of ending up with vehicles *k* and *l* this year given that the household owned two vehicles last period is conditioned on the probability that the household did not become a one-vehicle owner this period. As in the one vehicle case, it is assumed that two-vehicle owners cannot become zero-vehicle households, and that zero-vehicle households cannot become two-vehicle owners in one time period.

IV. SUBMODELS AND ESTIMATION RESULTS

Vehicle Choice

The vehicle choice portions of CALCARS were estimated using both stated (from the hypothetical vehicle choices) and revealed preference (actual ownership in 1993) data in a multinomial logit framework. The result is a representative utility for each vehicle choice or combination of two choices (defined as $U_{i,t}$ and $U_{i,j,t}$ in Section III) for a given set of demographic and vehicle characteristics. Vehicle choice functions were estimated separately for one- and two- vehicle owners. Tables 1a and 1b on pages 12 and 13 give the results of the estimation.

To match the shares of each vehicle class to the Wave 1 survey respondents's actual ownership shares, the vehicle choice coefficients estimated with stated preference data were supplemented with dummy constants from the revealed preference data in the survey. To do this, historical vehicle data by class and vintage for 1977-1993 (provided by K.G. Duleep of Environmental Analysis, Inc.) were applied to the estimated coefficients for each household for a prelimary measure of the utility of the currently held vehicle(s). Calibration to actual ownership shares resulted in the dummy constants given in Tables 1a and 1b. As shown in the tables, calibration was used to assign constants to a vehicle class or combination of classes taking into account household demographics, income, and vehicle age. Since the vehicle characteristics used in the Wave 1 survey did not include factors accounting for size (e.g. interior room) and age, the dummy constants were used to account for size/body style differences by household size and for vehicle vintage. For example, Table 1 shows that one vehicle households with more than three members place a significantly higher value on vans and larger autos than do smaller households. In addition, higher income households were found to place a higher value on luxury cars, sport utility vehicles, and newer vehicles in general than lower income households, a difference that could not be accounted for by relative purchase prices. The tables show constants only for those class or class combinations and vintages that yielded obvious dummy constant differences for smaller vs. larger and lower income vs. higher income households; many other class and vintage breakouts were tested. Note that this calibration process is separate from the calibration required to match vehicle totals by class and vintage to actual DMV totals in the base year.

Table 1a: One-Vehicle Choice Estimation Results

Explanatory Variable	Estimated Coefficient	t-statistic
Range	0.0032475	9.22
Purchase price (income#$15,000)	-0.000102	-3.79
Purchase price ($15,000<income#$45,000)	-0.0000607	-4.38
Purchase price ($45,000<income#$60,000)	-0.0000435	-1.77
Purchase price (income>$60,000)	-0.0000351	-1.35
Operating Cost	-0.08104	-8.3
Log of refuel or recharge time, service station	-0.2092	-3.52
Home refuel or recharge time	-0.0007593	-2.68
1 - service station availability--home		-2.02
refueling available, dedicated or dual fuel	-0.3621	-2.02
1 - service station availability--dual fuel, no home refueling available	-0.5081	-3.61
Log of service station availability-- dedicated, no home refuel available	0.3901	4.2
Acceleration	-0.0752	-5.25
Log of top speed	0.3262	3.08
Emissions--relative to 1993 gasoline car	-0.6189	-4.26
Luggage space--relative to similar gasoline car	0.2634	0.99

Dummy Constants

Subcompact car, HH members # 3	0.6745	Subcompact car, HH members # 3	0.5667
Midsize car, HH members # 3	0.3242	Midsize car, HH members > 3	1.0614
Large car, HH members # 3	-1.0189	Large car, HH members > 3	-0.5977
Luxury car, income # $60,000	-0.0659	Luxury car, income > $60,000	1.1071
Truck, HH members # 2	-0.8924	Truck, HH members > 2	-1.1197
Sport utility, income # $60,000	-1.3836	Sport utility, income > $60,000	-0.5994
Van, HH members # 3	-1.5430	Van, HH members > 3	0.8076

Vehicle age # 10 years, income # $30,000	0.4969
Vehicle age # 7 years, income > $30,000	1.4659
7 < vehicle age # 10, income > $30,000	1.1682

Number of observations = 1,426

Log-likelihood at zero = -5,110

Log-likelihood at zero = -4,337

Table 1b: Two-Vehicle Choice Estimation Results

Explanatory Variable	Estimated Coefficient	t-statistic
Range	0.003380	11.08
Purchase price (income#$15,000)	-0.000192	-3.49
Purchase price ($15,000<income#$60,000)	-0.0000674	-6.14
Purchase price ($60,000<income#$75,000)	-0.0000636	-3.06
Purchase price ($75,000<income#$100,000)	-0.0000385	-1.92
Purchase price (income>$100,000)	-0.0000121	-0.68
Operating cost (income # $100,000)	-0.08504	-9.55
Operating cost (income > $100,000)	-0.08075	-3.06
Log of refuel or recharge time, service station	-0.1157	-2.22
Home refuel or recharge time	-0.0002463	-0.98
1 - service station availability--home		-2.02
refueling available, dedicated or dual fuel	-0.1426	-0.89
1 - service station availability--dual fuel, no home refueling available	-0.4620	-3.83
Log of service station availability--dedicated, no home refuel available	0.3906	4.57
Acceleration	-0.06426	-5.17
Log of top speed (income # $60,000)	0.3345	3.06
Log of top speed (income > $60,000)	0.3606	2.59
Emissions (income # $75,000)	-0.3036	-2.34
Emissions (income > $75,000)	-0.4985	-2.86
Luggage space vs. similar gasoline car	0.5579	2.37

Dummy Constants

Subcompact/subcompact, HH members # 3		Subcompact/subcompact, HH members > 3	
Compact/midsize, HH members # 3		Compact/midsize, HH members > 3	
At least 1 of 2 cars is luxury, inc. # $75,000		At least 1 of 2 cars is luxury, inc. > $75,000	
Midsize car/truck, HH members # 3		Midsize car/truck, HH members > 3	
Large car/truck, HH members # 3	-	Large car/truck, HH members > 3	
Luxury car/truck, income # $75,000		Luxury car/truck, income > $75,000	
Other car/truck		Truck/truck	-
Car/van, HH members # 3	-	Car/van, HH members > 3	
Car/sport utility, income # $75,000	-	Car/sport utility, income > $75,000	-
Truck/van, HH members # 3	-	Truck/van, HH members > 3	
Truck/sport utility	-	Van/sport utility	-
Van/van	-	Sport utility/sport utility	-
Vehicle age # 5 years, income > $45,000		6 # vintage < 10, income > $45,000	
Vehicle age # 10 or 11 years, inc. > $45,000		Vehicle age # 10, income # $45,000	

Number of observations = 1,904

Log-likelihood at zero = -6823 Log-likelihood at convergence = -6050

Variables entered in either a logged or linear form[7], depending on goodness of fit. Perhaps surprisingly, vehicle range showed a better fit as a linear term than as a logged term, for both one- and two-vehicle households: households in the sample give the same worth to an increase in range from, for example, 50 to 100 miles as they do to an increase from 250 to 300 miles. Service station availability was estimated separately for vehicles with home refueling available, those with no home refueling capability but able to run on gasoline as well as the alternative fuel, and those with neither home refueling nor dual fuel capability. The first two types showed a linear relationship with utility while the latter fit best as a logged term. This means that zero fuel availability would drive the utility of these vehicles to zero, an intuitively appealing result.

To estimate the value of a given vehicle characteristic (in this case, 1993 dollars) over the life of a vehicle, the effect of a change in that characteristic on utility can be divided by the purchase price coefficient. For example, a one-vehicle household with income less than or equal to $15,000 would be willing to pay around $800 for a one cent drop in operating cost per mile over the life of the vehicle, while a household with income between $15,000 and $45,000 would be willing to pay roughly $1,300.[8] These estimated present values are difficult to interpret directly as they are based on household expectations of the future, such as expected vehicle life and the future price of fuel, along with the rate of future discount. To provide a simple example, if the vehicle were expected to provide 100,000 miles of service for the household (so that each cent of operating cost per mile meant expenses of $1,000 over the life of the vehicle), and the only other considerations were the price of fuel and the discount rate, the lower income household would discount the future at a higher annual rate than its expected rate of fuel price increase. For the higher income household, the reverse would be true.

Using the same two income groups within one-vehicle households, a one second increase in acceleration from 0-30 mph is worth roughly $700 and $1,200, a 10 mile increase in range is worth $300 and $500, and a 10 percent reduction in emissions from 1993 gasoline levels $600 and $1,000.[9] The value of service station availability depends on the type of vehicle. For example, an increase in service station availability for an alternative fuel from ten to

[7] Quadratic forms were also tested for certain variables but in no case found to give the best fit.

[8] In the PVM, low income one-vehicle households (income less than $12,000 in 1978 dollars--approximately $25,000 in 1993 dollars) showed a willingness to pay of $844 for a one-cent drop in operating cost. For higher income households, the figure was $1,134.

[9] It appears that California drivers are willing to pay more for a reduction in emissions than the incremental consumer cost as estimated by the California Air Resources Board (CARB). For example, CARB estimates the incremental consumer cost of an Ultra-Low Emission vehicle, which will produce less than 50 percent of the tailpipe emissions of 1993 vehicles, to be less than $300 (*1994 Low-Emission Vehicle and Zero-Emission Vehicle Program Review* , Staff Report, April, 1994). It should be noted, however, that automakers claim that actual costs will be much higher.

twenty percent of stations, for a two-vehicle household with income between $15,000 and $60,000, is worth $212 if the vehicle has home refueling capability, $685 if the AFV has no home refueling capability but is able to run on gasoline, and over $4,000 if the AFV cannot be refueled at home and is not dual-fuel.

Vehicle Quantity

Vehicle quantity was estimated as a function of the number of household members, number of full-time workers[10], availability of transit, and household income, using revealed preference, in a multinomial logit framework. The coefficients estimated are used to assign a representative utility of owning one and two vehicles for each household. The probability of owning zero, one, and two vehicles is then assigned based on these utilities. For example, the probability that a given household owns one vehicle in time period t, $P1CAR_t$ (as discussed in Section III), is specified as:

$$P1CAR_t = \frac{e^{U1CAR_t}}{e^{U0CAR_t} + e^{U1CAR_t} + e^{U2CAR_t}}, \tag{8}$$

where U0CAR (set equal to 0), U1CAR, and U2CAR are the representative utilities of owning zero, one, and two vehicles, respectively.

Estimation results are shown in Table 2 on the next page. The log sum of the exponentials of the representative utility of individual choices or combinations of two choices is also included as an explanatory variable to reflect the interdependence of vehicle quantity and vehicle choice (referred to as inclusive value and maximum expected utility in Section II). Intuitively, this term shows that the number of vehicles that a household owns depends on the attributes of vehicles currently available. For example, if the price of all vehicles were reduced, a household would be more likely to own one vehicle relative to none and two vehicles relative to one. As Table 2 shows, this variable appears to be very significant in explaining vehicle quantity decisions.

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[10] Full-time workers are defined as those working at least 30 hours a week regularly plus 0.4 times the number employed part-time (less than 30 hours a week). The total is rounded to the nearest integer. Thus a household with one member working 30 or more hours weekly and one member working part-time would be assigned one full-time worker, while a household with one member working 30 or more hours and two members working part-time would be assigned two full-time workers.

Table 2: Vehicle Quantity Estimation Results

Explanatory Variable	Estimated Coefficient	t-statistic
Number of full-time equivalent workers in the household (one-vehicle alternative)	0.6482	1.76
Number of full-time equivalent workers in the household (two-vehicle alternative)	1.0256	2.77
Natural log of the number of household members (one-vehicle alternative)	0.6304	1.27
Natural log of the number of household members (two-vehicle alternative)	2.7520	5.48
Availability of transit (one-vehicle alternative)	-0.0099	-2.05
Availability of transit (two-vehicle alternative)	-0.0139	-2.83
Expected maximum utility of available classes/vintages	0.3996	5.41
Alternative-Specific Constants		
Income # \$30,000 (one-vehicle alternative)	1.4046	2.31
Income # \$30,000 (two-vehicle alternative)	-3.1942	-3.25
\$30,000 < income # \$60,000 (one-vehicle alternative)	1.0556	1.43
\$30,000 < income # \$60,000 (two-vehicle alternative)	-2.5304	-2.30
Income > \$60,000 (one-vehicle alternative)	1.0672	1.06
Income > \$60,000 (two-vehicle alternative)	-2.2378	-1.62

Number of observations = 3,465

Log-likelihood at zero = -3,807 Log-likelihood at convergence = -1,777

Vehicle Replacement

Whenever a household replaces a vehicle, costs are incurred when selling the vehicle (fix-up costs, advertising, smog certification, etc.) and buying the replacement (search costs, taxes, etc.). These costs can be thought of as a disutility associated with replacing a vehicle. Denoting this disutility as *R*, the utility of a given replacement possibility *l* can be adjusted to $U_l - R$. If a one-vehicle household owns vehicle *k* in time period *t*, the probability that vehicle *l* will be owned in period *t*+1 is then

$$P_l = \frac{e^{U_{l,t+1}-R}}{e^{U_{k,t+1}}+\sum_{l\neq k} e^{U_{l,t+1}-R}}. \qquad \textbf{(9)}$$

Given current ownership of vehicle *k*, the probability that this vehicle will be replaced next period is simply the sum of the probabilities of owning each of all vehicles except *k:*

$$\textit{Replacement Probability} = \sum_{l\neq k} \frac{e^{U_{l,t+1}-R}}{e^{U_{k,t+1}}+\sum_{l\neq k} e^{U_{l,t+1}-R}}$$

$$= \frac{\sum_{l\neq k} e^{U_{l,t+1}-R}}{e^{U_{k,t+1}}+\sum_{l\neq k} e^{U_{l,t+1}-R}}. \qquad \textbf{(10)}$$

transforming (10) in the following manner (suppressing time subscripts):

$$\frac{\sum_{l\neq k} e^{U_l - R}}{e^{U_k}+\sum_{l\neq k} e^{U_l - R}} = \frac{e^{-R}\sum_{l\neq k} e^{U_l}}{e^{U_k}+e^{-R}\sum_{l\neq k} e^{u_l}} \times \frac{e^{-U_k}}{e^{-U_k}} = \frac{e^{-R}\sum_{l\neq k} e^{U_l} e^{-U_k}}{1+e^{-R}\sum_{l\neq k} e^{U_l} e^{-U_k}}, \qquad \textbf{(11)}$$

and using the fact that, for any value $x>0$,

$$x = e^{\ln x}, \qquad \textbf{(12)}$$

we can write

$$\textit{Replacement Probability} = \frac{e^{-R\cdot\ln(\Sigma_{i\neq k}e^{U_i})-U_k}}{1+e^{-R\cdot\ln(\Sigma_{i\neq k}e^{U_i})-U_k}}. \qquad \textbf{(13)}$$

(13) is in the form of a binomial logit specification,

$$\textit{Probability}(Y_i=1) = \frac{e^{\alpha+\beta X_i}}{1+e^{\alpha+\beta X_i}}, \qquad \textbf{(14)}$$

where in our case $Y_i = 1$ would correspond to a replacement being made and $\alpha + \beta X_i$ would become:

$$\alpha + \beta(\ln(\Sigma_{i\neq k}e^{U_{i,t}})-U_{k,t}), \qquad \textbf{(15)}$$

which can be thought of as a measure of the desirability (utility) of replacing vehicle *k*. The term in parentheses multiplied by β on the right-hand side of (15) will be referred to as the *relative attractiveness* of a vehicle.

If the utility of currently held vehicle *k* changes (for example, due to an operating cost increase) so that its utility becomes $U_k + \gamma$ (where γ<0 for a loss in utility and γ>0 for a gain), while there is no change in the attributes of other vehicles, repeating the process shown in (9)-(13) would give

$$\textit{Replacement Probability} = \frac{e^{-R\cdot\ln(\Sigma_{i\neq k}e^{U_i})-(U_k+\gamma)}}{1+e^{-R\cdot\ln(\Sigma_{i\neq k}e^{U_i})-(U_k+\gamma)}}. \qquad \textbf{(16)}$$

This means that a change in utility for a currently held vehicle would change the desirability of replacing that vehicle (15) by exactly the utility change. In other words, the coefficient β in (14) should equal one. Note that if the utility of all other vehicles also changed by γ, replacement probability would reduce to (13)--there would be no change in the probability of replacing vehicle *k*.

Table 3 on the next page shows the vehicle replacement estimation results. For a more precise measurement of the effects of age, vehicle class, and vehicle attributes on the replacement decision, these were entered separately in the estimation. The measure of relative attractiveness therefore includes the value of the "bundle" of vehicle attributes (the

Table 3: Vehicle Replacement Submodel Estimation Results

	One-Vehicle Households		Two-Vehicle Households	
Explanatory Variable	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
Age of Vehicle	0.2501	2.59	0.3153	2.46
Age squared	-0.0102	-1.53	-0.0151	-1.49
Number of full-time equivalent workers	0.1111	1.28	0.2298	2.65
Relative attractiveness of vehicle	1.2031	1.39	0.9328	1.01
Dummy: van or sport utility	0.6301	2.04	--	--
Constant	-9.3561	-2.02	-8.5385	-1.75
	Number of observations = 852		Number of observations = 1159	
	Log-likelihood at zero = -376		Log-likelihood at zero = -405	
	Log-likelihood at convergence = -358		Log-likelihood at convergence = -391	

Table 4: New/Used Submodel Estimation Results

	One-Vehicle Households		Two-Vehicle Households	
Dummy	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$15,000 < income # $30,000	0.7324	2.44	--	--
$30,000 < income # $45,000	--	--	0.3980	1.11
$30,000 < income # $60,000	1.1878	2.44	--	--
$45,000 < income # $60,000	--	--	0.6256	1.91
Income > $60,000	1.5686	1.72	--	--
$60,000 < income # $75,000	--	--	1.2321	2.99
$75,000 < income # $100,000	--	--	1.3347	3.10
Income > $100,000	--	--	1.9408	4.02
Constant	-0.47	-1.17	-0.3314	-1.34
	Number of observations = 141		Number of observations = 344	
	Log-likelihood at zero = -95		Log-likelihood at zero = -231	
	Log-likelihood at convergence = -92		Log-likelihood at convergence = -218	

vehicle characteristics applied to the estimated coefficients for one- and two-vehicle households) without the estimated dummies for age and size class. Dummies for class size were included in the initial specification but, with the exception of vans and sport utility vehicles[11] in the one-vehicle case, were not found to be significant explanatory variables. In the two-vehicle case, characteristics of the other vehicle (e.g., age and class) were also included in the initial specification but did not yield significant coefficients, suggesting a high degree of independence between the two vehicles in a replacement decision. Age of the vehicle was included both by itself and squared to reflect the apparent decline in replacement probability occurring in households with the oldest vehicles (i.e., classic, collectors). The number of full-time equivalent workers in the household was included as a proxy for vehicle use.[12]

As should be the case, the coefficients for relative attractiveness are not significantly different from one. The relatively low t-statistics for this variable are likely a reflection of the use of average vehicle characteristics by class and vintage (supplied by K.G. Duleep, Environmental Analysis, Inc.) to represent the attributes of vehicles currently held in the sample.

New/Used Submodel

The choice of whether a replacement or added vehicle is new or used is modeled as a function of income using stated preference responses. The submodel is specified as binomial logit where the dependent variable is set to one if the respondent, given the intent to replace or add a vehicle in the next year, expects the replacement or addition to be new, and zero otherwise. Results are given in Table 5 on the previous page. To provide an example of the difference among income groups, two-vehicle households with income above $100,000 are roughly twice as likely to replace an existing vehicle with a new one than are two-vehicle households with income below $30,000.

In other holdings models, new vehicles are simply another choice available for a household, lumped together with used vehicles. CALCARS addresses the new/used issue specifically with the assumption that choosing between a new and a used vehicle is a fundamental decision when a replacement/addition decision has been made; that is, it seems more realistic to model vehicle choice as first a decision as to whether the vehicle will be new or used and then as a choice within the desired option.

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[11] One-vehicle households in the survey appeared more willing to part with vans and sport utility vehicles than other types. Roughly 23 percent of van and sport utility owners in these households indicated their intention of replacing these vehicles in the next year compared to 15 percent for the other vehicle types.

[12] Other factors related to vehicle use, such as number of household members and household income, were included in the initial specification, but were not found to be significant (t-statistic < 1).

VMT Submodel

Based on revealed preference (that is, respondents' estimates of annual VMT in the previous year), Tables 5a and 5b on pages 19 and 20 show the results of the ordinary least squares regressions for one- and two-vehicles households, respectively. Specifically, the natural log of estimated VMT was regressed on various household- and vehicle-specific characteristics. In the two-vehicle case, characteristics of the other vehicle (age, type, and operating cost) were included as a way of accounting for substitution between vehicles. For example, a household owning a relatively fuel efficient vehicle and another vehicle with lower fuel economy will drive the first vehicle a higher proportion of total household VMT if a higher fuel tax is imposed. This can be seen by rewriting the effect of the two operating costs as follows:

$$\alpha_1 OC_1 + \alpha_2 OC_2 = \alpha_2 (OC_2 - OC_1) + (\alpha_1 + \alpha_2) OC_1,$$

where OC_1 is the operating cost of the vehicle whose VMT is being estimated and OC_2 is the operating cost of the other vehicle. If the vehicle with operating cost OC_1 is the more fuel efficient, a fuel tax will raise the operating cost per mile of the vehicle by less than the other. Therefore, a fuel tax will reduce VMT in the "gas guzzler" by more than that of the vehicle with higher fuel economy.

Vehicle characteristics (age, type, and operating cost) are taken as given in the VMT estimation. As a household's travel demand will influence the vehicle choice, this introduces a bias into the parameter estimates. However, corrections for this self selectivity bias that have been applied empirically in utilization models have not had significant effects on estimation results (Train, 1986; Hensher et al, 1992).

Respondents' estimates of VMT for each of their two chosen hypothetical vehicles were used to test for any impact of characteristics such as low range and fuel availability on travel. Ideally, for two vehicle households, these impacts would be tested taking into account the other vehicle (that which remained in the household after the indicated change in the fleet). That is, the specification for a hypothetical vehicle would be given as:

$$\ln(VMT_H) = \alpha + \ldots + \gamma_1 FA + \gamma_2 FA_o + \gamma_3 R + \gamma_4 R_o + \ldots + \varepsilon, \tag{18}$$

where *FA* represents fuel availability, *R* range, the subscript *H* hypothetical, and the subscript *o* the other vehicle. Unfortunately, FA_o would by definition always equal one as the other vehicle is fueled by gasoline. The same problem would occur in testing for the effects of refueling time and luggage space (as the latter is given as a percentage of that of a gasoline vehicle). Instead, the difference in the log of respondents' estimated annual VMT between the two chosen vehicles (if any) was regressed on the difference in vehicle characteristics

Table 5a: VMT Submodel Estimation Results (One-Vehicle Households)

Explanatory Variable	Estimated Coefficient	t-statistic
Natural log of the number of household members	0.0655	1.54
Number of full-time equivalent workers	0.3005	7.77
Transit ridership per capita	-0.000068	-0.12
Operating cost (income # $15,000)	-0.0676	-3.58
Operating cost ($15,000 < income # $30,000)	-0.0444	-2.41
Operating cost (income > $30,000)	-0.0322	-1.81
Age of vehicle (mini car)	-0.0241	-2.98
Age of vehicle (subcompact car)	-0.0400	-5.70
Age of vehicle (compact car)	-0.0172	-2.10
Age of vehicle (midsize car)	-0.0337	-5.00
Age of vehicle (large car)	-0.0262	-2.36
Age of vehicle (sports car)	-0.0294	-2.69
Dummies		
Luxury car	0.1270	1.26
Sports car	0.1411	1.18
Standard truck	0.2056	1.15
Constant	9.3670	93.04

Number of observations = 1,203

R-squared = 0.19

Table 5b: VMT Submodel Estimation Results (Two-Vehicle Households)

Explanatory Variable	Estimated Coefficient	t-statistic
Natural log of the number of household members	0.1381	4.09
Number of full-time equivalent workers	0.1453	7.20
Transit ridership per capita	-0.00019	-0.52
Operating cost (income # $30,000)	-0.0386	-2.00
Operating cost ($30,000 < income # $45,000)	-0.0182	-1.18
Operating cost (income > $45,000)	-0.0062	-0.40
Operating cost of other vehicle (income # $30,000)	0.0174	0.99
Operating cost of other vehicle (income > $30,000)	0.0029	0.22
Age of vehicle (subcompact car)	-0.0294	-5.32
Age of vehicle (compact car)	-0.0456	-7.32
Age of vehicle (midsize car)	-0.0373	-6.15
Age of vehicle (large car)	-0.0501	-4.79
Age of vehicle (luxury car)	-0.0383	-4.98
Age of vehicle (sports car)	-0.0276	-4.62
Age of vehicle (compact truck)	-0.0272	-4.14
Age of vehicle (standard truck)	-0.0350	-3.25
Age of vehicle (compact van)	-0.0312	-2.32
Age of vehicle (standard sport utility)	-0.0469	-2.67
Age of vehicle (small sport utility)	-0.0372	-2.58
Age of other vehicle (midsize car)	0.0140	1.67
Age of other vehicle (luxury car)	0.0170	2.52
Age of other vehicle (compact truck)	0.0084	1.38
Age of other vehicle (standard van)	0.0188	1.17
Age of other vehicle (small sport utility)	0.0118	0.99
Dummies		
Mini car	-0.4337	-6.24
Sport utility	0.1564	1.78
Other vehicle is a mini car	0.0902	1.29
Other vehicle is a subcompact car	0.0919	2.08
Other vehicle is a midsize car	-0.1331	-1.97
Other vehicle is a sports car	0.1002	2.03
Other vehicle is a standard truck	-0.1324	-1.63
Constant	9.2199	86.53
Number of observations = 1,203		
R-squared = 0.19		

between the two vehicles. With this method, household- and other vehicle-specific characteristics cancel out, leaving the change in the log of VMT specified as a function of the difference in vehicle characteristics and dummies for any difference in body style/size between the two hypothetical vehicles. In this way, the effect of fuel availability, range, home and service station refueling times, tailpipe emissions, and luggage space relative to a similar gasoline vehicle was estimated, given changes in operating cost, and body style/size.

One-vehicle households showed no VMT effect from any of these characteristics. Intuitively, vehicles are chosen with a certain travel demand in mind, so this is not a surprising result. In the two-vehicle case, fuel availability[13] and range differences did have a slight effect on VMT estimates. Given the assumption of no change in travel demand for these households (as evidenced by the one-vehicle case), any reduction in VMT due to these two characteristics should be made up by higher VMT in the other vehicle. In other words, a vehicle with low range and/or fuel availability is driven less, all else equal, while the other vehicle (assuming higher range and/or fuel availability) is driven more. Specifically, two-vehicle households appeared to reduce their VMT estimates from one hypothetical vehicle choice to another only if the range of the first exceeded 250 miles while the range of the second was less than 250.[14] Unlike range, the effect of the difference in fuel availability between the two vehicles did not appear to depend on the level in either vehicle.

Table 6 below presents the results of this analysis. The estimated coefficients for range and fuel availability represent an adjustment to the apportionment of VMT between vehicles in two-vehicle households.

Table 6: VMT Adjustment for Range* and Fuel Availability
(Standard errors in parentheses)

Operating Cost Difference	Body Style/Size Difference**	Range Difference	Fuel Avail. Difference
-0.0054 (0.0088)	--	0.00096 (0.00045)	0.1385 (0.1129)

* For the lowest range vehicle for those sets of choices where one vehicle had a range higher than 250 miles and the other a range less than 250.
** Not reported--multiple dummies accounting for differences in body style/size between the two hypothetical vehicles.

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[13] Unlike the vehicle choice estimation, the effect of fuel availability did not appear to differ between dedicated and dual fuel vehicles and between vehicles with home refuel capability and vehicles without.

[14] Intuitively, a range effect beginning at 250 miles is plausible as it represents approximately a lower bound for today's gasoline vehicles.

For example, consider two vehicles, each of which would otherwise be driven 10,000 miles per year. If one has a range of greater than or equal to 250 miles while the second has a range of 100, the VMT of the second would become 10,000 * exp(0.00096*(100-250)) = 8,659 miles. The difference (1341 miles) would then be added to the first vehicle. If both of these vehicles had a range greater than or equal to 250 miles but the fuel availability of the first was 1 (the fuel was available at 100% of service stations) and that of the second was 0.5 (50% of service stations), the VMT of the second vehicle would become 10,000 * exp(0.1385*(0.5-1)) = 9,331 while that of the second would be 10,000 + (10,000-9,331) =10,669.

Fuel Choice Submodel

The submodel for fuel choice is the only portion of CALCARS that was not estimated at the CEC. In 1991, the CEC sponsored a "pilot" survey to explore the potential for alternative fuel vehicles in California, an effort on a much smaller scale than the current ITS work. Out of this work came a routine (modeled as binomial logit) for estimating the use of gasoline relative to an alternative fuel in dual-fuel vehicles. The percentage of fillups using the alternative fuel is modeled as a function of fuel price, range, fuel availability, and emissions for gasoline and the alternative fuel, along with various household demographic characteristics (Bunch *et al*., 1992).

VI. CALCARS FORECASTS

This section describes input data, assumptions, and results for a number of forecasts for California: a "base" scenario and three sensitivity runs, including a one dollar higher tax on gasoline. The results are meant to show the feasibility of CALCARS as a forecasting tool and should not be interpreted as official CEC forecasts. CALCARS is currently set up to forecast for 17 vintages and 28 classes, representing four different fuel types: gasoline, methanol (M85), compressed natural gas (CNG), and electricity, although other fuel types (e.g., liquid propane, ethanol) could be included with the required input data. The forecast period is 1994-2015, with 1994 serving as the base year.

Data Inputs

Economic/demographic projections for population, employment, and household income come from the CEC Demand Analysis Office. CALCARS simulates at a household level, using 48 "composite" households, each representing some segment of the California population (for example, one composite represents households with one member, one full-time worker, and income between $10,000 and $20,000). Actual forecasts from the model come from multiplying the results from the simulated household by the number of similar households in the state.[15]

Fuel prices are forecasted by the Fuels Office of the CEC, and prices for various years are given in Table 7, below. Gasoline prices show a significant increase in 1995 and 1996 due to federal and state reformulated gasoline regulations. Prices for CNG and electricity reflect a weighted average of prices throughout the state.[16]

Table 7: Projected Fuel Prices used in CALCARS Base Forecast

Year	Gasoline (1995$/gal.)	M85 (1995$/gal.)	CNG (1995$/therm)	Electricity (1995$/KWH)
1995	1.38	1.13	0.79	0.079
1996	1.48	0.98	0.86	0.079
2000	1.50	1.06	1.14	0.079
2005	1.49	1.09	1.11	0.079
2010	1.50	1.11	1.09	0.080
2015	1.52	1.12	1.10	0.080

A description of the 28 size classes projected to be available at some time during the forecast period is given in Table 8 below. The 14 gasoline classes are available for all historical (1978-1993) and forecast (1994-2015) years, while the flexible-fuel methanol[17] (FFV) class becomes available in 1996 and the natural gas and electric fueled classes (NGVs and EVs, respectively) become available in 2001.[18] Projected and historical vehicle attributes for vehicle price, fuel efficiency, acceleration, range, and top speed come from K.G. Duleep

[15] For example, if CALCARS assigns a 0.1 probability of vehicle *k* being owned in a given year, and there are 100,000 households in the state represented by the composite, this household will contribute 100,000*0.1 = 10,000 of vehicle *k* to the forecast.

[16] Prices in the various utility districts in California are weighted by projected population in that district.

[17] Runs on both methanol and gasoline fuel.

[19] As CALCARS has no mechanism to model new technology (capturing perceived risk, etc.), 2001 was chosen as a reasonable year in which to assume sufficient familiarity with natural gas and electric vehicles by the general public. Before 2001, personal sales of these fuel types are assumed to be negligible, with most of the penetration coming from commercial fleet vehicles. FFVs, on the other hand, are very similar to current gasoline vehicles.

(Environmental Analysis Inc.) a recognized expert in vehicle technology. All other attributes come from CEC analysis. The appendix gives all vehicle attributes, except for luggage space relative to a similar gasoline class, by size class, model year, and fuel type for these classes. NGVs are assumed to have 70 percent of the luggage space of similar gasoline classes due to space required for fuel tanks while EVs and FFVs are assumed to have the same as similar gasoline vehicles. Prices as given in the appendix are for the vehicles when new. To convert to used prices, CALCARS uses depreciation factors also provided by Duleep. Attributes given for 1978 (vintage 17) are meant to represent an average of characteristics for all vehicles of this model year and older.

Base year (1994) vehicle projections are calibrated to actual 1994 totals by class and vintage for the 14 gasoline classes derived from data from the California Department of Motor Vehicles. The resulting calibration constants, meant to represent the mean of all omitted

Table 8: Vehicle Classes and Descriptions

Class	Description	Class	Description
1	Gasoline Mini Car	15	Methanol Midsize Car (flexible fuel)
2	Gasoline Subcompact Car	16	CNG Subcompact Car
3	Gasoline Compact Car	17	CNG Compact Car
4	Gasoline Midsize Car	18	CNG Midsize Car
5	Gasoline Large Car	19	CNG Large Car
6	Gasoline Luxury Car	20	CNG Standard Pickup
7	Gasoline Sports Car	21	CNG Compact Van
8	Gasoline Compact Truck	22	CNG Standard Van
9	Gasoline Standard Truck	23	Electric Mini Car
10	Gasoline Compact Van	24	Electric Subcompact Car
11	Gasoline Standard Van	25	Electric Compact Car
12	Gasoline Compact Sport Utility	26	Electric Sports Car
13	Gasoline Standard Sport Utility	27	Electric Compact Pickup
14	Gasoline Mini Sport Utility	28	Electric Compact Van

variables in the utility functions, are then applied throughout the forecast period. Alternative fuel vehicles are assigned the calibration constants of similar gasoline classes (e.g., the compact CNG auto class is assigned the estimated constants of the compact gasoline car class).

Forecast Assumptions

The base case forecast described below is meant to be a scenario reflecting a reasonably-expected-to-occur assessment of the future. As such, incorporated into the simulation are rules and regulations that have already been adopted and, barring unforeseen circumstances, will be implemented according to a specified schedule.

First, the purchase incentives of the 1992 National Energy Policy Act (EPACT) are included. EPACT provides a tax deduction (up to $2,000) for NGVs and a 10 percent tax credit (up to $4,000) for EVs. Plans are for each of these incentives to be phased out by 2005.

As discussed above, CARB reformulated gasoline regulations, which become operative in 1996, are introduced through an increase in the price of gasoline. In addition, the resulting fall in the energy content of gasoline (roughly four percent) is included through an adjustment to gasoline fuel efficiency.

Although CARB has recently removed the zero-emission vehicle (ZEV) mandates for 1998 and 2001, ZEVs (i.e., electric vehicles) are still mandated to make up ten percent of light-duty vehicle sales beginning in 2003. The base forecast assumes that this goal is met for personal vehicles, so EV sale prices are reduced until the required penetration is achieved. The amount of price reduction necessary indirectly offers a test of the feasibility of attaining ten percent sales, given currently foreseen technology.

Two types of EV batteries are included in the forecast. In 2001 and 2002, EVs are assumed to be powered by lead-acid batteries, which must be replaced after approximately 30,000 miles. Beginning in 2003, nickel metal hydride batteries, with a life of 50,000 miles and a slightly higher cost than lead-acid, are phased in, with all new EVs assumed to possess this technology by 2007.[19] Battery replacement manufacturer cost and projected retail price (in 1995$) for the six EV classes (also provided by K.G. Duleep) are shown in Table 9 below. For purposes of the forecast, battery replacement costs are converted to a per mile increment

[19] Battery costs between 2002 and 2007 represent a linear interpolation between the costs of lead-acid and nickel metal hydride.

to operating cost, discounted at an annual rate of 20 percent.[20] To allow the 2003 ZEV mandate to be met, the manufacturer costs for battery replacement are used in forecasts.

Table 9: EV Battery Replacement Costs (1995$)

EV Class	LEAD-ACID				NICKEL METAL HYDRIDE			
	Manufacturer Cost		Retail Price		Manufacturer Cost		Retail Price	
	Total	Per Mile*	Total	Per Mile*	Total	Per Mile*	Total	Per Mile*
Mini Car	1,471	0.028	2,648	0.049	1,665	0.013	2,997	0.023
Subcompact Car	3,988	0.073	7,178	0.132	4,513	0.035	8,123	0.062
Compact Car	4,669	0.086	8,404	0.154	5,283	0.040	9,509	0.073
Sports Car	4,669	0.086	8,404	0.154	5,283	0.040	9,509	0.073
Compact Pickup	6,974	0.128	12,553	0.231	7,883	0.060	14,189	0.109
Compact Van	6,119	0.112	11,014	0.202	6,916	0.053	12,449	0.095

* Calculated by discounting the appropriate total at an annual rate of 20 percent and then dividing by the life of the battery (30,000 for lead-acid and 50,000 for nickel metal hydride)

Base Forecast

For the base forecast and each sensitivity run, tables will be presented showing stock, VMT, and fuel use for total personal vehicles by fuel type for 2001, 2005, 2010, and 2015. The same information will be given for new personal vehicles for 2001, 2003, 2005, 2010, and 2015. 2003 is presented for new vehicles because of the CARB mandate for 10 percent penetration for electric vehicles. Fuel use is given in gasoline-equivalent gallons (one gasoline-equivalent gallon = 111,000 BTUs). Note that one gallon of M85 equals 65,015 BTUs, one therm of CNG equals 100,000 BTUs, and one KWH of electricity equals 3,413 BTUs.

[20] Based on "Implicit Discount Rates and the Purchase of Untried, Energy-Saving Durable Goods" by Douglas A. Houston (Journal of Consumer Research, Vol. 10, September, 1981) and "Individual Discount Rates and the Purchase of Energy-Using Durables" by Jerry A. Hausman (Bell Journal of Economics, 1979)

Tables 10 and 11 show the base case results. By 2015, alternative fuel vehicles make up around six percent of total personal stock and roughly 13 percent of new personal vehicles. Electric vehicles account for most of the AFV's due to the ZEV regulations. To achieve the ten percent requirement in 2003, electric vehicles had to be priced $2,000 (in 1993$) less than similar gasoline vehicles (e.g., a compact EV had to be $2,000 less than a gasoline compact car). By 2005, the mandate could be met with the same prices for gasoline and electric vehicles, and the two fuel types were priced the same over the rest of the forecast period. These same prices for EVs were used in all of the sensitivity cases. Improvements in EV characteristics allowed these vehicles to claim 13 percent of new sales by 2010.

Flexible-fuel methanol and natural gas vehicles claimed much lower penetration levels compared to EVs. In the FFV case, demand was limited by the availability of only one class (midsize car). In addition, these vehicles use gasoline a large majority of the time, so M85 VMT and fuel use is very low relative to total stock and sales (gasoline VMT and fuel use by FFVs is added to the gasoline totals). Natural gas vehicles, even with seven size classes available, show low totals as they are dedicated vehicles with no home refueling option--the low fuel availability affects these vehicles much more than EVs and FFVs.

Sensitivity Case 1: Higher Alternative Fuel Availability

In this scenario, vehicles fueled by M85, CNG, and electricity were assumed to face a service station fuel availability of 10 percent of that of gasoline beginning in 2001, compared to less than two percent in the base case. Tables 12 and 13 show the results of this run.

The fuel type benefiting the most from the fuel availability increase is CNG. The stock and sales of NGVs doubles in 2001, and by 2015 the number of these vehicles on the road is projected to be 388,000, up from 150,000 in the base case. The increase in NGVs comes at the expense of gasoline vehicles--the market share of new gasoline vehicles drops by over two percent in each forecast year from 2001 on.
]
EV and FFV demand, much less sensitive to service station fuel availability, see only a mild increase in stock and sales. FFV VMT and fuel use increase at a higher rate than stock and sales, as the higher fuel availability results in higher M85 use relative to gasoline in these vehicles compared to the base case. However, the vast majority of fuel use for FFVs remains gasoline.

Table 10: Base Case Forecast for Total Personal Vehicles

Year	Fuel Type	Stock (thousands)	Stock %	VMT (millions)	Fuel Use*
2001	Gasoline	20,564	99.4	203,669	9,621
	Methanol	62	0.3	40	1.6
	CNG	26	0.1	283	11
	Electric	42	0.2	406	3.9
	Total	20,694		204,398	9,638
2005	Gasoline	21,376	97.6	212,225	9,687
	Methanol	89	0.4	47	1.8
	CNG	82	0.4	830	32
	Electric	359	1.6	3,343	28
	Total	21,906		216,445	9,749
2010	Gasoline	22,298	95.3	219,315	9,568
	Methanol	105	0.4	54	2.0
	CNG	123	0.5	1,176	44
	Electric	860	3.7	7,887	56
	Total	23,386		228,432	9,669
2015	Gasoline	23,357	94.1	228,512	9,470
	Methanol	151	0.6	87	3.1
	CNG	150	0.6	1,378	48
	Electric	1166	4.7	10,210	70
	Total	24,824		240,187	9,591

* Given in million gasoline-equivalent gallons.

Table 11: Base Forecast for New Personal Vehicles

Year	Fuel Type	New Sales (thousands)	% Sales	% ZEV*
2001	Gasoline	1,045	93.1	
	Methanol	9	0.8	
	CNG	26	2.3	
	Electric	42	3.7	
	Total	1,122		
2003	Gasoline	1,073	89.1	
	Methanol	10	0.8	
	CNG	26	2.2	
	Electric	95	7.9	10
	Total	1,204		
2005	Gasoline	1,088	88.1	
	Methanol	10	0.8	
	CNG	26	2.1	
	Electric	110	8.9	11
	Total	1,234		
2010	Gasoline	1,235	86.4	
	Methanol	12	0.8	
	CNG	31	2.2	
	Electric	151	10.6	13
	Total	1,429		
2015	Gasoline	1,431	86.6	
	Methanol	14	0.8	
	CNG	36	2.2	
	Electric	171	10.3	13
	Total	1,652		

* The California Air Resources Board Zero Emission Vehicle mandates (electric vehicles are currently the only fuel type that qualify) stipulate ten percent ZEVs out of new auto and light-duty truck sales beginning in 2003. The Board's weight limit for light-duty trucks is lower than that used by the CEC, such that roughly 50 percent of the CEC's light-duty trucks do not meet the Board's criterion. Therefore, this entry in the table gives the percentage of EV sales out of new autos and 50 percent of the light-duty trucks that are forecast.

Table 12: Higher Alternative Fuel Availability Case for Total Personal Vehicles

Year	Fuel Type	Stock (thousands)	Stock %	VMT (millions)	Fuel Use*
2001	Gasoline	1022	99.2	203,398	9,609
	Methanol	10	0.3	41	1.6
	CNG	52	0.3	572	23
	Electric	42	0.2	407	3.9
	Total	20,695		204,417	9,638
2005	Gasoline	21,251	97.0	211,084	9,636
	Methanol	91	0.4	53	2.0
	CNG	209	1.0	2,138	83
	Electric	361	1.6	3,402	28
	Total	21,912		216,678	9,479
2010	Gasoline	22,094	94.4	217,682	9,494
	Methanol	110	0.5	64	2.3
	CNG	321	1.4	3,072	114
	Electric	871	3.7	8,079	57
	Total	23,396		228,897	9,668
2015	Gasoline	23,108	93.0	226,694	9,388
	Methanol	157	0.6	101	3.6
	CNG	388	1.6	3,574	126
	Electric	1182	4.8	10,474	171
	Total	24,835		240,843	9,588

* Given in million gasoline-equivalent gallons.

Table 13: Higher Alternative Fuel Availability Case for New Personal Vehicles

Year	Fuel Type	New Sales (thousands)	% Sales	% ZEV*
2001	Gasoline	1,022	90.8	
	Methanol	10	0.9	
	CNG	52	4.6	
	Electric	42	3.7	
	Total	1,126		
2003	Gasoline	1,056	87.0	
	Methanol	10	0.8	
	CNG	53	4.4	
	Electric	95	7.8	10
	Total	1,214		
2005	Gasoline	1,079	86.1	
	Methanol	10	0.8	
	CNG	54	4.3	
	Electric	110	8.8	11
	Total	1,253		
2010	Gasoline	1,236	84.3	
	Methanol	13	0.9	
	CNG	63	4.3	
	Electric	154	10.5	13
	Total	1,466		
2015	Gasoline	1,440	84.5	
	Methanol	15	0.9	
	CNG	75	4.4	
	Electric	174	10.2	13
	Total	1,704		

* The California Air Resources Board Zero Emission Vehicle mandates (electric vehicles are currently the only fuel type that qualify) stipulate ten percent ZEVs out of new auto and light-duty truck sales beginning in 2003. The Board's weight limit for light-duty trucks is lower than that used by the CEC, such that roughly 50 percent of the CEC's light-duty trucks do not meet the Board's criterion. Therefore, this entry in the table gives the percentage of EV sales out of new autos and 50 percent of the light-duty trucks that are forecast.

Sensitivity Case 2: No Credit for Emissions

In this scenario, no credit is given for tailpipe emissions levels for any of the fuel types. Tables 14 and 15 give the results of this run.

Not surprisingly, electric vehicle demand (with zero tailpipe emissions) suffers the most in this case. By 2015, EV stock falls by around 25 percent relative to the base case and EV sales drop by almost twenty percent in this year. More significantly, the ZEV mandate is not met in 2003, even with EVs priced $2,000 less than comparable gasoline vehicles. NGV stock, with less of an emission advantage over gasoline and M85, drops by ten percent by 2015. FFVs, with no emission improvement in the base case, and gasoline vehicles see an increased demand.

Sensitivity Case 3: $1 Higher Tax on Gasoline

In this case, the price of gasoline (in 1995$) is raised by one dollar beginning in 2001. Tables 16 and 17 show the results of this run.

By 2015, total personal gasoline stock falls by almost one million vehicles while the number of alternative fuel vehicles rises by around 50 percent. Total personal VMT drops by roughly four percent while energy use drops by nine percent.   Note that energy demand drops by a greater percentage than VMT due to a switch to more fuel efficient vehicles--personal stock fuel efficiency rises by five percent by the end of the forecast period. Also by 2015, the market share for new gasoline vehicles drops to 82.8 percent, from 86.6 percent in the base case. The higher gasoline tax causes new EV sales to rise by 35 percent in 2003.

Table 14: No Emission Credit Case for Total Personal Vehicles

Year	Fuel Type	Stock (thousands)	Stock %	VMT (millions)	Fuel Use*
2001	Gasoline	20,569	99.4	202,564	9,589
	Methanol	60	0.3	46	1.8
	CNG	24	0.1	264	11
	Electric	34	0.2	332	3.2
	Total	20,687		203,206	9,605
2005	Gasoline	21,463	98.0	210,861	9,674
	Methanol	90	0.4	67	2.6
	CNG	70	0.3	719	28
	Electric	268	1.2	2,503	20
	Total	21,891		214,151	9,726
2010	Gasoline	22,513	96.3	218,773	9,640
	Methanol	113	0.5	88	3.2
	CNG	109	0.5	1,041	39
	Electric	635	2.7	5,843	41
	Total	23,370		225,745	9,723
2015	Gasoline	23,643	95.3	229,141	9,610
	Methanol	165	0.7	141	5.0
	CNG	135	0.5	1,245	44
	Electric	864	3.5	7,571	52
	Total	24,807		238,098	9,711

* Given in million gasoline-equivalent gallons.

Table 15: No Emission Credit Case for New Personal Vehicles

Year	Fuel Type	New Sales (thousands)	% Sales	% ZEV*
2001	Gasoline	1,112	94.2	
	Methanol	10	0.8	
	CNG	25	2.1	
	Electric	34	2.9	
	Total	1,180		
2003	Gasoline	1,148	91.0	
	Methanol	11	0.9	
	CNG	25	2.0	
	Electric	78	6.2	8
	Total	1,262		
2005	Gasoline	1,166	90.2	
	Methanol	11	0.9	
	CNG	25	1.9	
	Electric	90	7.0	8
	Total	1,292		
2010	Gasoline	1,311	88.8	
	Methanol	13	0.9	
	CNG	29	2.0	
	Electric	123	8.3	10
	Total	1,476		
2015	Gasoline	1,514	88.9	
	Methanol	16	0.9	
	CNG	34	2.0	
	Electric	139	8.2	10
	Total	1,703		

* The California Air Resources Board Zero Emission Vehicle mandates (electric vehicles are currently the only fuel type that qualify) stipulate ten percent ZEVs out of new auto and light-duty truck sales beginning in 2003. The Board's weight limit for light-duty trucks is lower than that used by the CEC, such that roughly 50 percent of the CEC's light-duty trucks do not meet the Board's criterion. Therefore, this entry in the table gives the percentage of EV sales out of new autos and 50 percent of the light-duty trucks that are forecast.

Table 16: $1 Higher Tax on Gasoline Case for Total Personal Vehicles

Year	Fuel Type	Stock (thousands)	Stock %	VMT (millions)	Fuel Use*
2001	Gasoline	20,214	99.2	190,012	8,884
	Methanol	73	0.4	227	9.2
	CNG	36	0.2	396	16
	Electric	58	0.3	567	5.5
	Total	20,381		191,203	8,914
2005	Gasoline	20,838	96.4	198,721	8,850
	Methanol	136	0.6	365	14
	CNG	126	0.6	1,301	51
	Electric	527	2.4	4,998	42
	Total	21,627		205,385	8,957
2010	Gasoline	21,492	92.9	204,384	8,650
	Methanol	166	0.7	417	15
	CNG	184	0.8	1,790	67
	Electric	1,288	5.6	11,992	86
	Total	23,130		218,583	8,817
2015	Gasoline	22,386	91.0	213,121	8,554
	Methanol	228	0.9	592	21
	CNG	217	0.9	2,040	72
	Electric	1,759	7.2	15,639	101
	Total	24,590		231,393	8,754

* Given in million gasoline-equivalent gallons.

Table 17: $1 Higher Gasoline Tax Case for New Personal Vehicles

Year	Fuel Type	New Sales (thousands)	% Sales	% ZEV*
2001	Gasoline	1,013	90.4	
	Methanol	13	1.2	
	CNG	36	3.2	
	Electric	58	5.2	
	Total	1,120		
2003	Gasoline	1,037	85.4	
	Methanol	13	1.1	
	CNG	36	3.0	
	Electric	128	10.5	13
	Total	1,214		
2005	Gasoline	1,045	84.3	
	Methanol	13	1.0	
	CNG	35	2.8	
	Electric	146	11.8	14
	Total	1,239		
2010	Gasoline	1,196	82.4	
	Methanol	16	1.1	
	CNG	41	2.8	
	Electric	199	13.7	16
	Total	1,452		
2015	Gasoline	1,402	82.8	
	Methanol	19	1.1	
	CNG	48	2.8	
	Electric	224	13.2	16
	Total	1,693		

* The California Air Resources Board Zero Emission Vehicle mandates (electric vehicles are currently the only fuel type that qualify) stipulate ten percent ZEVs out of new auto and light-duty truck sales beginning in 2003. The Board's weight limit for light-duty trucks is lower than that used by the CEC, such that roughly 50 percent of the CEC's light-duty trucks do not meet the Board's criterion. Therefore, this entry in the table gives the percentage of EV sales out of new autos and 50 percent of the light-duty trucks that are forecast.

APPENDIX: VEHICLE CHARACTERISTICS

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
1978	1	8852	19.70	4.70	91	296	1.000	1.00	7	0
1978	2	10814	19.20	4.66	77	307	1.000	1.00	7	0
1978	3	11932	13.50	4.59	92	263	1.000	1.00	7	0
1978	4	10591	13.70	4.34	95	281	1.000	1.00	7	0
1978	5	11837	12.30	4.16	98	302	1.000	1.00	7	0
1978	6	26309	11.00	4.01	100	308	1.000	1.00	7	0
1978	7	12275	13.60	3.78	104	285	1.000	1.00	7	0
1978	8	9489	13.30	4.08	80	279	1.000	1.00	7	0
1978	9	10508	8.50	3.80	88	256	1.000	1.00	7	0
1978	10	10502	11.50	5.87	72	345	1.000	1.00	7	0
1978	11	12569	10.20	4.27	78	305	1.000	1.00	7	0
1978	12	8597	11.00	4.64	83	275	1.000	1.00	7	0
1978	13	12426	8.50	3.69	89	299	1.000	1.00	7	0
1978	14	16045	19.90	4.27	88	298	1.000	1.00	7	0
1979	1	8786	20.00	4.41	94	300	1.000	1.00	7	0
1979	2	10734	20.00	4.71	76	309	1.000	1.00	7	0
1979	3	11845	13.10	4.65	91	256	1.000	1.00	7	0
1979	4	10514	14.30	4.11	99	278	1.000	1.00	7	0
1979	5	11749	12.70	4.16	98	305	1.000	1.00	7	0
1979	6	26598	11.50	3.89	102	312	1.000	1.00	7	0
1979	7	12186	14.20	3.82	103	299	1.000	1.00	7	0
1979	8	9584	16.00	3.87	83	336	1.000	1.00	7	0
1979	9	10498	10.20	3.59	91	286	1.000	1.00	7	0
1979	10	12700	13.50	5.87	72	379	1.000	1.00	7	0
1979	11	11910	9.70	3.85	83	273	1.000	1.00	7	0
1979	12	10679	11.90	4.00	92	298	1.000	1.00	7	0
1979	13	13282	8.40	3.45	93	293	1.000	1.00	7	0
1979	14	16045	19.90	4.27	88	298	1.000	1.00	7	0
1980	1	8605	24.80	4.53	93	348	1.000	1.00	7	0
1980	2	10446	22.30	4.56	81	335	1.000	1.00	7	0
1980	3	11447	19.40	4.02	100	349	1.000	1.00	7	0
1980	4	10850	17.60	4.44	94	335	1.000	1.00	7	0
1980	5	11916	16.20	4.26	97	357	1.000	1.00	7	0
1980	6	26841	15.90	4.32	96	349	1.000	1.00	7	0
1980	7	11835	18.90	3.92	102	341	1.000	1.00	7	0
1980	8	9616	19.90	3.95	82	359	1.000	1.00	7	0
1980	9	10468	14.40	3.82	88	359	1.000	1.00	7	0
1980	10	15401	16.00	5.87	72	400	1.000	1.00	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
1980	11	11241	13.80	4.04	81	346	1.000	1.00	7	0
1980	12	13239	15.80	4.03	91	379	1.000	1.00	7	0
1980	13	14093	12.00	3.73	89	360	1.000	1.00	7	0
1980	14	13852	24.20	4.37	87	363	1.000	1.00	7	0
1981	1	9942	27.40	4.55	93	356	1.000	1.00	7	0
1981	2	12158	25.30	4.47	78	380	1.000	1.00	7	0
1981	3	14087	20.60	4.06	100	349	1.000	1.00	7	0
1981	4	14003	19.20	4.48	93	345	1.000	1.00	7	0
1981	5	15104	17.50	4.39	95	368	1.000	1.00	7	0
1981	6	31601	16.20	4.30	96	340	1.000	1.00	7	0
1981	7	14224	20.30	4.00	100	344	1.000	1.00	7	0
1981	8	11799	22.20	3.92	82	355	1.000	1.00	7	0
1981	9	12824	15.60	3.91	86	374	1.000	1.00	7	0
1981	10	19014	15.60	5.87	72	374	1.000	1.00	7	0
1981	11	13765	14.60	4.05	81	351	1.000	1.00	7	0
1981	12	14541	17.40	4.36	87	400	1.000	1.00	7	0
1981	13	17673	13.10	3.79	88	392	1.000	1.00	7	0
1981	14	13237	28.00	4.43	86	419	1.000	1.00	7	0
1982	1	10824	28.20	4.67	91	366	1.000	1.00	7	0
1982	2	11374	27.20	4.31	76	407	1.000	1.00	7	0
1982	3	15213	22.50	4.12	99	360	1.000	1.00	7	0
1982	4	14986	20.20	4.34	95	353	1.000	1.00	7	0
1982	5	16369	17.30	4.12	99	363	1.000	1.00	7	0
1982	6	34284	17.50	4.25	97	368	1.000	1.00	7	0
1982	7	15403	19.70	3.70	106	316	1.000	1.00	7	0
1982	8	12142	22.20	3.81	84	355	1.000	1.00	7	0
1982	9	13376	15.60	3.93	82	375	1.000	1.00	7	0
1982	10	19601	18.20	6.31	69	438	1.000	1.00	7	0
1982	11	14339	14.40	4.04	81	346	1.000	1.00	7	0
1982	12	14708	17.00	4.23	88	390	1.000	1.00	7	0
1982	13	18807	14.00	3.87	83	420	1.000	1.00	7	0
1982	14	12085	26.70	4.03	91	400	1.000	1.00	7	0
1983	1	10192	30.30	4.53	93	364	1.000	1.00	7	0
1983	2	11461	28.50	4.33	74	400	1.000	1.00	7	0
1983	3	15155	23.30	4.17	98	372	1.000	1.00	7	0
1983	4	15239	20.10	4.18	98	342	1.000	1.00	7	0
1983	5	16895	16.90	4.15	98	355	1.000	1.00	7	0
1983	6	34435	17.80	4.09	99	374	1.000	1.00	7	0
1983	7	15852	20.30	3.56	108	325	1.000	1.00	7	0
1983	8	11954	22.10	3.94	82	353	1.000	1.00	7	0
1983	9	13527	15.20	3.88	83	379	1.000	1.00	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
1983	10	18321	16.20	5.87	72	406	1.000	1.00	7	0
1983	11	14704	14.80	4.00	81	371	1.000	1.00	7	0
1983	12	15995	18.50	4.11	90	408	1.000	1.00	7	0
1983	13	18496	13.80	3.84	83	414	1.000	1.00	7	0
1983	14	11094	25.20	3.98	92	379	1.000	1.00	7	0
1984	1	11402	28.20	4.25	97	338	1.000	1.00	7	0
1984	2	11541	29.40	4.33	74	382	1.000	1.00	7	0
1984	3	14692	23.60	4.08	99	354	1.000	1.00	7	0
1984	4	15117	20.40	4.10	99	347	1.000	1.00	7	0
1984	5	17034	17.20	4.04	100	353	1.000	1.00	7	0
1984	6	34064	17.80	3.99	101	365	1.000	1.00	7	0
1984	7	16541	20.70	3.32	113	321	1.000	1.00	7	0
1984	8	11630	21.70	3.90	83	358	1.000	1.00	7	0
1984	9	13407	14.70	3.83	83	367	1.000	1.00	7	0
1984	10	15767	20.60	4.53	85	516	1.000	1.00	7	0
1984	11	15062	14.30	3.90	83	358	1.000	1.00	7	0
1984	12	16180	18.40	4.31	87	386	1.000	1.00	7	0
1984	13	18700	14.20	4.00	81	426	1.000	1.00	7	0
1984	14	11537	24.30	3.82	94	364	1.000	1.00	7	0
1985	1	12047	28.40	4.05	100	340	1.000	1.00	7	0
1985	2	11259	28.90	4.16	78	376	1.000	1.00	7	0
1985	3	15153	23.60	3.78	104	354	1.000	1.00	7	0
1985	4	15664	21.20	4.01	100	349	1.000	1.00	7	0
1985	5	18535	18.70	3.76	104	373	1.000	1.00	7	0
1985	6	33119	18.60	3.89	102	372	1.000	1.00	7	0
1985	7	16651	21.20	3.34	113	329	1.000	1.00	7	0
1985	8	11416	21.90	3.82	84	361	1.000	1.00	7	0
1985	9	14176	14.80	3.69	85	333	1.000	1.00	7	0
1985	10	15463	19.60	3.98	92	441	1.000	1.00	7	0
1985	11	15024	13.90	3.74	85	314	1.000	1.00	7	0
1985	12	17407	18.70	4.30	88	392	1.000	1.00	7	0
1985	13	20071	13.30	3.55	88	400	1.000	1.00	7	0
1985	14	11676	24.40	4.42	86	293	1.000	1.00	7	0
1986	1	11374	29.10	4.23	97	349	1.000	1.00	7	0
1986	2	11392	29.70	4.16	79	357	1.000	1.00	7	0
1986	3	15435	23.80	3.86	103	357	1.000	1.00	7	0
1986	4	15866	21.40	3.87	103	354	1.000	1.00	7	0
1986	5	18462	20.60	3.60	107	401	1.000	1.00	7	0
1986	6	34094	19.80	3.56	108	385	1.000	1.00	7	0
1986	7	16541	22.00	3.32	113	341	1.000	1.00	7	0
1986	8	11296	21.60	3.70	85	356	1.000	1.00	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
1986	9	14563	15.10	3.71	85	340	1.000	1.00	7	0
1986	10	16291	19.30	3.90	93	435	1.000	1.00	7	0
1986	11	16049	14.60	3.80	84	329	1.000	1.00	7	0
1986	12	17630	18.10	3.97	92	380	1.000	1.00	7	0
1986	13	21123	13.60	3.62	86	409	1.000	1.00	7	0
1986	14	11201	27.50	4.01	92	316	1.000	1.00	7	0
1987	1	12214	28.80	4.14	98	345	1.000	1.00	7	0
1987	2	11501	28.60	4.02	84	344	1.000	1.00	7	0
1987	3	16134	24.00	3.75	105	360	1.000	1.00	7	0
1987	4	15173	22.10	3.74	105	364	1.000	1.00	7	0
1987	5	19848	20.10	3.64	107	393	1.000	1.00	7	0
1987	6	35736	18.70	3.56	108	356	1.000	1.00	7	0
1987	7	18327	21.80	3.26	114	338	1.000	1.00	7	0
1987	8	12409	21.40	3.68	86	364	1.000	1.00	7	0
1987	9	15745	14.80	3.58	87	332	1.000	1.00	7	0
1987	10	17250	19.40	3.59	98	435	1.000	1.00	7	0
1987	11	16684	14.40	3.74	85	325	1.000	1.00	7	0
1987	12	19383	18.30	3.66	97	383	1.000	1.00	7	0
1987	13	22966	13.30	3.48	89	400	1.000	1.00	7	0
1987	14	10939	27.80	4.19	89	319	1.000	1.00	7	0
1988	1	11026	29.90	4.13	98	358	1.000	1.00	7	0
1988	2	10710	29.20	4.15	81	350	1.000	1.00	7	0
1988	3	15276	24.20	3.65	106	364	1.000	1.00	7	0
1988	4	15699	22.90	3.74	105	377	1.000	1.00	7	0
1988	5	19328	20.90	3.57	108	407	1.000	1.00	7	0
1988	6	37643	19.00	3.49	110	361	1.000	1.00	7	0
1988	7	16645	22.00	3.32	113	341	1.000	1.00	7	0
1988	8	12899	21.20	3.62	87	360	1.000	1.00	7	0
1988	9	16130	15.20	3.40	90	341	1.000	1.00	7	0
1988	10	18676	19.40	3.48	100	435	1.000	1.00	7	0
1988	11	16861	14.70	3.33	91	332	1.000	1.00	7	0
1988	12	18968	17.80	3.50	100	373	1.000	1.00	7	0
1988	13	22903	13.50	3.19	94	405	1.000	1.00	7	0
1988	14	11219	28.00	4.21	89	322	1.000	1.00	7	0
1989	1	10800	30.30	4.11	99	363	1.000	1.00	7	0
1989	2	10778	29.00	4.03	85	348	1.000	1.00	7	0
1989	3	14905	24.30	3.63	107	365	1.000	1.00	7	0
1989	4	16343	22.60	3.59	108	372	1.000	1.00	7	0
1989	5	19532	20.50	3.49	110	399	1.000	1.00	7	0
1989	6	37140	19.10	3.44	111	363	1.000	1.00	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
1989	7	16263	22.30	3.31	113	346	1.000	1.00	7	0
1989	8	13368	20.60	3.50	88	351	1.000	1.00	7	0
1989	9	16019	15.20	3.42	90	341	1.000	1.00	7	0
1989	10	17320	19.40	3.50	100	436	1.000	1.00	7	0
1989	11	17167	14.60	3.36	91	328	1.000	1.00	7	0
1989	12	19419	17.80	3.35	103	373	1.000	1.00	7	0
1989	13	22521	13.50	3.22	93	404	1.000	1.00	7	0
1989	14	13775	26.50	3.68	97	305	1.000	1.00	7	0
1990	1	12257	31.25	3.53	109	375	1.000	1.00	7	0
1990	2	11391	28.36	3.88	102	369	1.000	1.00	7	0
1990	3	16006	24.09	3.62	107	361	1.000	1.00	7	0
1990	4	18072	21.91	3.56	108	361	1.000	1.00	7	0
1990	5	19996	20.50	3.46	110	400	1.000	1.00	7	0
1990	6	36766	18.98	3.25	115	361	1.000	1.00	7	0
1990	7	16339	22.18	3.27	114	344	1.000	1.00	7	0
1990	8	12999	20.75	3.36	91	353	1.000	1.00	7	0
1990	9	16789	15.12	3.21	93	340	1.000	1.00	7	0
1990	10	19217	19.17	3.46	89	383	1.000	1.00	7	0
1990	11	17122	14.62	3.33	91	365	1.000	1.00	7	0
1990	12	21004	18.03	3.31	92	361	1.000	1.00	7	0
1990	13	23105	13.61	3.16	94	408	1.000	1.00	7	0
1990	14	13784	25.45	3.73	85	293	1.000	1.00	7	0
1991	1	12234	31.85	3.63	107	382	1.000	1.00	7	0
1991	2	11364	28.87	3.99	101	375	1.000	1.00	7	0
1991	3	15928	24.17	3.72	105	363	1.000	1.00	7	0
1991	4	18022	22.06	3.67	106	364	1.000	1.00	7	0
1991	5	19949	20.72	3.56	108	404	1.000	1.00	7	0
1991	6	36626	19.22	3.37	113	365	1.000	1.00	7	0
1991	7	16209	22.47	3.38	112	348	1.000	1.00	7	0
1991	8	12943	20.93	3.45	89	356	1.000	1.00	7	0
1991	9	16741	15.31	3.30	92	344	1.000	1.00	7	0
1991	10	19169	19.42	3.56	88	388	1.000	1.00	7	0
1991	11	17070	14.77	3.43	90	369	1.000	1.00	7	0
1991	12	20944	18.18	3.41	90	364	1.000	1.00	7	0
1991	13	23050	13.72	3.25	93	412	1.000	1.00	7	0
1991	14	13732	25.65	3.84	83	295	1.000	1.00	7	0
1992	1	12252	32.29	3.66	106	388	1.000	1.00	7	0
1992	2	11378	29.24	4.02	100	380	1.000	1.00	7	0
1992	3	15927	24.40	3.75	105	366	1.000	1.00	7	0
1992	4	18034	22.37	3.70	106	369	1.000	1.00	7	0
1992	5	19939	20.82	3.60	107	406	1.000	1.00	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
1992	6	36613	19.46	3.40	112	370	1.000	1.00	7	0
1992	7	16182	22.66	3.42	111	351	1.000	1.00	7	0
1992	8	12946	21.11	3.49	89	359	1.000	1.00	7	0
1992	9	16732	15.40	3.33	91	346	1.000	1.00	7	0
1992	10	19178	19.63	3.59	87	393	1.000	1.00	7	0
1992	11	17061	14.85	3.46	89	371	1.000	1.00	7	0
1992	12	20938	18.27	3.45	89	365	1.000	1.00	7	0
1992	13	23038	13.77	3.29	92	413	1.000	1.00	7	0
1992	14	13745	25.93	3.88	83	298	1.000	1.00	7	0
1993	1	12282	32.97	3.69	106	396	1.000	1.00	7	0
1993	2	11403	29.79	4.06	100	387	1.000	1.00	7	0
1993	3	15939	24.77	3.78	104	372	1.000	1.00	7	0
1993	4	18059	22.79	3.74	105	376	1.000	1.00	7	0
1993	5	19943	20.99	3.63	107	409	1.000	1.00	7	0
1993	6	36620	19.82	3.44	111	377	1.000	1.00	7	0
1993	7	16175	23.00	3.45	110	356	1.000	1.00	7	0
1993	8	12954	21.32	3.52	88	362	1.000	1.00	7	0
1993	9	16726	15.51	3.37	91	349	1.000	1.00	7	0
1993	10	19197	19.94	3.62	86	399	1.000	1.00	7	0
1993	11	17055	14.96	3.50	88	374	1.000	1.00	7	0
1993	12	20946	18.43	3.48	89	369	1.000	1.00	7	0
1993	13	23028	13.84	3.32	91	415	1.000	1.00	7	0
1993	14	13766	26.26	3.92	82	302	1.000	1.00	7	0
1994	1	12649	33.52	3.71	105	402	1.000	0.79	7	0
1994	2	11750	30.13	4.08	99	392	1.000	0.79	7	0
1994	3	16265	24.97	3.78	104	375	1.000	0.79	7	0
1994	4	18401	23.32	3.72	105	385	1.000	0.79	7	0
1994	5	20200	21.10	3.61	107	411	1.000	0.79	7	0
1994	6	36785	20.16	3.37	113	383	1.000	0.79	7	0
1994	7	16443	23.19	3.43	111	359	1.000	0.79	7	0
1994	8	13307	21.39	3.55	88	364	1.000	0.79	7	0
1994	9	17078	15.51	3.37	90	349	1.000	1.00	7	0
1994	10	19572	20.05	3.62	87	401	1.000	0.79	7	0
1994	11	17407	14.95	3.50	88	374	1.000	1.00	7	0
1994	12	21306	18.40	3.48	89	368	1.000	0.79	7	0
1994	13	23383	13.79	3.31	92	414	1.000	1.00	7	0
1994	14	14156	26.58	3.92	82	306	1.000	0.79	7	0
1995	1	12666	33.98	3.75	105	408	1.000	0.77	7	0
1995	2	11767	30.56	4.12	99	397	1.000	0.77	7	0
1995	3	16273	25.25	3.81	104	379	1.000	0.77	7	0
1995	4	18430	23.70	3.75	105	391	1.000	0.77	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
1995	5	20236	21.45	3.65	107	418	1.000	0.77	7	0
1995	6	36789	20.48	3.41	112	389	1.000	0.77	7	0
1995	7	16443	23.53	3.47	110	365	1.000	0.77	7	0
1995	8	13320	21.63	3.58	87	368	1.000	0.77	7	0
1995	9	17074	15.62	3.41	90	352	1.000	0.83	7	0
1995	10	19585	20.28	3.66	86	406	1.000	0.77	7	0
1995	11	17402	15.05	3.54	88	376	1.000	0.83	7	0
1995	12	21322	18.61	3.51	88	372	1.000	0.77	7	0
1995	13	23373	13.86	3.35	91	416	1.000	0.83	7	0
1995	14	14188	26.79	3.92	82	308	1.000	0.77	7	0
1996	1	12934	32.59	3.81	104	391	1.000	0.76	7	0
1996	2	12032	29.30	4.20	97	381	1.000	0.76	7	0
1996	3	16540	24.18	3.87	103	363	1.000	0.76	7	0
1996	4	18721	22.77	3.81	104	376	1.000	0.76	7	0
1996	5	20534	20.63	3.69	106	402	1.000	0.76	7	0
1996	6	37073	19.66	3.44	111	374	1.000	0.76	7	0
1996	7	16691	22.60	3.53	109	350	1.000	0.76	7	0
1996	8	13596	20.78	3.65	86	353	1.000	0.76	7	0
1996	9	17333	14.91	3.46	89	335	1.000	0.65	7	0
1996	10	19879	19.48	3.70	85	390	1.000	0.76	7	0
1996	11	17662	14.38	3.59	87	359	1.000	0.65	7	0
1996	12	21620	17.86	3.56	88	357	1.000	0.76	7	0
1996	13	23634	13.21	3.39	90	396	1.000	0.65	7	0
1996	14	14494	25.61	3.92	82	295	1.000	0.76	7	0
1996	15	19921	23.78	3.55	108	230	0.005	0.66	7	0
1997	1	12991	32.69	3.76	104	392	1.000	0.69	7	0
1997	2	12095	29.46	4.15	98	383	1.000	0.69	7	0
1997	3	16595	24.27	3.82	103	364	1.000	0.69	7	0
1997	4	18784	22.89	3.76	105	378	1.000	0.69	7	0
1997	5	20609	20.79	3.65	107	405	1.000	0.69	7	0
1997	6	37178	19.77	3.38	112	376	1.000	0.69	7	0
1997	7	16799	22.73	3.48	110	352	1.000	0.69	7	0
1997	8	13653	20.85	3.61	87	355	1.000	0.69	7	0
1997	9	17375	14.91	3.42	90	335	1.000	0.65	7	0
1997	10	19937	19.57	3.66	86	391	1.000	0.69	7	0
1997	11	17708	14.42	3.55	88	360	1.000	0.65	7	0
1997	12	21687	17.97	3.51	88	359	1.000	0.69	7	0
1997	13	23676	13.23	3.35	91	397	1.000	0.65	7	0
1997	14	14558	25.79	3.87	83	297	1.000	0.69	7	0
1997	15	19984	23.99	3.54	109	232	0.005	0.66	7	0
1998	1	13060	33.10	3.71	105	397	1.000	0.60	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
1998	2	12167	29.88	4.09	99	388	1.000	0.60	7	0
1998	3	16669	24.62	3.77	104	369	1.000	0.60	7	0
1998	4	18866	23.20	3.71	106	383	1.000	0.60	7	0
1998	5	20697	21.07	3.60	107	411	1.000	0.60	7	0
1998	6	37312	20.10	3.33	114	382	1.000	0.60	7	0
1998	7	16924	23.05	3.43	111	357	1.000	0.60	7	0
1998	8	13714	21.03	3.56	87	357	1.000	0.60	7	0
1998	9	17424	14.96	3.38	90	337	1.000	0.62	7	0
1998	10	19992	19.70	3.61	87	394	1.000	0.60	7	0
1998	11	17762	14.51	3.51	88	363	1.000	0.62	7	0
1998	12	21761	18.14	3.47	89	363	1.000	0.60	7	0
1998	13	23727	13.30	3.31	92	399	1.000	0.62	7	0
1998	14	14668	26.44	3.82	84	304	1.000	0.60	7	0
1998	15	20066	24.41	3.52	109	236	0.005	0.66	7	0
1999	1	13427	34.23	3.72	105	411	1.000	0.53	7	0
1999	2	12543	30.90	4.11	99	402	1.000	0.53	7	0
1999	3	17054	25.35	3.77	104	380	1.000	0.53	7	0
1999	4	19240	23.77	3.70	106	392	1.000	0.53	7	0
1999	5	21049	21.57	3.59	108	421	1.000	0.53	7	0
1999	6	37608	20.83	3.28	115	396	1.000	0.53	7	0
1999	7	17326	23.76	3.43	111	368	1.000	0.53	7	0
1999	8	13890	21.35	3.54	88	363	1.000	0.53	7	0
1999	9	17485	15.04	3.34	91	338	1.000	0.59	7	0
1999	10	20269	20.01	3.59	87	400	1.000	0.53	7	0
1999	11	17839	14.71	3.46	89	368	1.000	0.59	7	0
1999	12	21962	18.44	3.44	89	369	1.000	0.53	7	0
1999	13	23802	13.45	3.27	92	404	1.000	0.59	7	0
1999	14	15075	27.49	3.83	84	316	1.000	0.53	7	0
1999	15	20440	25.10	3.55	109	242	0.005	0.66	7	0
2000	1	13480	34.59	3.68	106	415	1.000	0.44	7	0
2000	2	12596	31.22	4.07	99	406	1.000	0.44	7	0
2000	3	17107	25.66	3.73	105	385	1.000	0.44	7	0
2000	4	19298	24.03	3.67	106	397	1.000	0.44	7	0
2000	5	21103	21.78	3.55	108	425	1.000	0.44	7	0
2000	6	37703	21.09	3.23	116	401	1.000	0.44	7	0
2000	7	17427	24.08	3.38	112	373	1.000	0.44	7	0
2000	8	13937	21.52	3.51	88	366	1.000	0.44	7	0
2000	9	17533	15.14	3.31	92	341	1.000	0.56	7	0
2000	10	20324	20.22	3.56	88	404	1.000	0.44	7	0
2000	11	17900	14.90	3.43	90	373	1.000	0.56	7	0
2000	12	22019	18.65	3.40	90	373	1.000	0.44	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
2000	13	23863	13.63	3.23	93	409	1.000	0.56	7	0
2000	14	15110	27.67	3.78	84	318	1.000	0.44	7	0
2000	15	20498	25.49	3.56	108	246	0.005	0.66	7	0
2001	1	13634	34.88	3.66	106	419	1.000	0.44	7	0
2001	2	12750	31.51	4.04	100	410	1.000	0.44	7	0
2001	3	17264	25.90	3.70	106	389	1.000	0.44	7	0
2001	4	19464	24.25	3.64	107	400	1.000	0.44	7	0
2001	5	21266	21.95	3.52	109	428	1.000	0.44	7	0
2001	6	37907	21.28	3.19	117	404	1.000	0.44	7	0
2001	7	17628	24.36	3.35	112	378	1.000	0.44	7	0
2001	8	14083	21.61	3.49	89	367	1.000	0.44	7	0
2001	9	17687	15.21	3.29	92	342	1.000	0.53	7	0
2001	10	20490	20.39	3.53	88	408	1.000	0.44	7	0
2001	11	18073	15.10	3.40	90	377	1.000	0.53	7	0
2001	12	22178	18.79	3.37	91	376	1.000	0.44	7	0
2001	13	24032	13.79	3.20	94	414	1.000	0.53	7	0
2001	14	15250	27.74	3.76	85	319	1.000	0.44	7	0
2001	15	20664	25.71	3.52	109	248	0.005	0.66	7	0
2001	16	15463	35.34	4.60	92	93	0.016	0.31	7	0
2001	17	19977	29.05	4.21	97	88	0.016	0.31	7	0
2001	18	22177	27.20	4.14	98	91	0.016	0.31	7	0
2001	19	23978	24.62	4.01	100	97	0.016	0.31	7	0
2001	20	21491	17.06	3.74	85	100	0.016	0.31	7	0
2001	21	24293	22.88	4.01	81	119	0.016	0.31	7	0
2001	22	21877	16.94	3.87	83	110	0.016	0.31	7	0
2001	23	16022	4.49	3.66	93	70	0.016	0.00	7	360
2001	24	19347	3.68	4.04	88	70	0.016	0.00	7	360
2001	25	24673	3.17	3.70	93	70	0.016	0.00	7	360
2001	26	25000	3.17	3.35	99	70	0.016	0.00	7	360
2001	27	23072	2.79	3.49	78	70	0.016	0.00	7	360
2001	28	30260	2.45	3.53	77	70	0.016	0.00	7	360
2002	1	13686	35.29	3.62	107	423	1.000	0.43	7	0
2002	2	12809	31.97	4.00	100	416	1.000	0.43	7	0
2002	3	17324	26.31	3.66	106	395	1.000	0.43	7	0
2002	4	19531	24.61	3.60	108	406	1.000	0.43	7	0
2002	5	21332	22.29	3.49	110	435	1.000	0.43	7	0
2002	6	38008	21.61	3.16	117	411	1.000	0.43	7	0
2002	7	17731	24.77	3.31	113	384	1.000	0.43	7	0
2002	8	14129	21.82	3.45	89	371	1.000	0.43	7	0
2002	9	17734	15.32	3.26	92	345	1.000	0.52	7	0
2002	10	20546	20.63	3.50	88	413	1.000	0.43	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
2002	11	18145	15.37	3.37	90	384	1.000	0.52	7	0
2002	12	22234	19.03	3.34	91	381	1.000	0.43	7	0
2002	13	24099	14.03	3.17	94	421	1.000	0.52	7	0
2002	14	15295	28.02	3.72	85	322	1.000	0.43	7	0
2002	15	19804	26.12	3.50	110	252	0.005	0.66	7	0
2002	16	15662	35.85	4.55	93	94	0.016	0.31	7	0
2002	17	20177	29.50	4.17	98	89	0.016	0.31	7	0
2002	18	22384	27.61	4.10	99	92	0.016	0.31	7	0
2002	19	24185	25.01	3.97	101	98	0.016	0.31	7	0
2002	20	21678	17.18	3.71	85	101	0.016	0.31	7	0
2002	21	24489	23.13	3.98	81	121	0.016	0.31	7	0
2002	22	22089	17.24	3.84	83	112	0.016	0.31	7	0
2002	23	15942	4.51	3.62	94	70	0.016	0.00	7	360
2002	24	19245	3.69	4.00	88	70	0.016	0.00	7	360
2002	25	24611	3.18	3.66	93	70	0.016	0.00	7	360
2002	26	24988	3.18	3.31	99	70	0.016	0.00	7	360
2002	27	22846	2.79	3.45	78	70	0.016	0.00	7	360
2002	28	30120	2.46	3.50	77	70	0.016	0.00	7	360
2003	1	13740	35.74	3.58	108	429	1.000	0.42	7	0
2003	2	12870	32.47	3.96	101	422	1.000	0.42	7	0
2003	3	17387	26.73	3.63	107	401	1.000	0.42	7	0
2003	4	19602	25.00	3.57	108	412	1.000	0.42	7	0
2003	5	21406	22.69	3.46	110	442	1.000	0.42	7	0
2003	6	38117	21.99	3.12	118	418	1.000	0.42	7	0
2003	7	17839	25.24	3.27	114	391	1.000	0.42	7	0
2003	8	14178	22.06	3.42	90	375	1.000	0.42	7	0
2003	9	17783	15.45	3.24	93	348	1.000	0.50	7	0
2003	10	20602	20.89	3.46	89	418	1.000	0.42	7	0
2003	11	18215	15.60	3.35	91	390	1.000	0.50	7	0
2003	12	22292	19.29	3.31	92	386	1.000	0.42	7	0
2003	13	24164	14.24	3.15	95	427	1.000	0.50	7	0
2003	14	15354	28.45	3.68	86	327	1.000	0.42	7	0
2003	15	19875	26.51	3.47	110	256	0.005	0.66	7	0
2003	16	15863	36.42	4.51	93	96	0.016	0.31	7	0
2003	17	20380	29.98	4.13	99	91	0.016	0.31	7	0
2003	18	22595	28.04	4.06	100	94	0.016	0.31	7	0
2003	19	24399	25.45	3.93	102	100	0.016	0.31	7	0
2003	20	21867	17.33	3.68	86	101	0.016	0.31	7	0
2003	21	24686	23.43	3.94	82	122	0.016	0.31	7	0
2003	22	22299	17.50	3.81	84	114	0.016	0.31	7	0
2003	23	15840	5.24	3.61	94	80	0.016	0.00	7	180

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
2003	24	19114	4.29	4.00	88	80	0.016	0.00	7	180
2003	25	24516	3.69	3.64	94	80	0.016	0.00	7	180
2003	26	24945	3.69	3.29	100	80	0.016	0.00	7	180
2003	27	22579	3.24	3.46	78	80	0.016	0.00	7	180
2003	28	29931	2.85	3.48	78	80	0.016	0.00	7	180
2004	1	14083	36.04	3.61	107	432	1.000	0.42	7	0
2004	2	13216	32.82	4.00	100	427	1.000	0.42	7	0
2004	3	17743	27.00	3.64	107	405	1.000	0.42	7	0
2004	4	19968	25.21	3.58	108	416	1.000	0.42	7	0
2004	5	21778	22.93	3.47	110	447	1.000	0.42	7	0
2004	6	38504	22.18	3.11	119	421	1.000	0.42	7	0
2004	7	18198	25.56	3.29	114	396	1.000	0.42	7	0
2004	8	14512	22.13	3.46	89	376	1.000	0.42	7	0
2004	9	18133	15.50	3.26	93	349	1.000	0.50	7	0
2004	10	20959	21.00	3.48	89	420	1.000	0.42	7	0
2004	11	18580	15.74	3.37	91	393	1.000	0.50	7	0
2004	12	22648	19.37	3.32	91	387	1.000	0.42	7	0
2004	13	24538	14.36	3.15	94	431	1.000	0.50	7	0
2004	14	15701	28.64	3.70	85	329	1.000	0.42	7	0
2004	15	20241	26.74	3.48	110	258	0.005	0.66	7	0
2004	16	16349	36.81	4.55	93	97	0.016	0.31	7	0
2004	17	20876	30.28	4.15	98	92	0.016	0.31	7	0
2004	18	23101	28.27	4.08	99	94	0.016	0.31	7	0
2004	19	24911	25.71	3.94	101	101	0.016	0.31	7	0
2004	20	22357	17.38	3.71	85	101	0.016	0.31	7	0
2004	21	25183	23.55	3.96	82	122	0.016	0.31	7	0
2004	22	22804	17.65	3.83	83	115	0.016	0.31	7	0
2004	23	17023	5.24	3.61	94	80	0.016	0.00	7	180
2004	24	20486	4.29	4.00	88	80	0.016	0.00	7	180
2004	25	26128	3.69	3.64	94	80	0.016	0.00	7	180
2004	26	26572	3.69	3.29	100	80	0.016	0.00	7	180
2004	27	24207	3.24	3.46	78	80	0.016	0.00	7	180
2004	28	31876	2.85	3.48	78	80	0.016	0.00	7	180
2005	1	14145	36.79	3.57	108	441	1.000	0.42	7	0
2005	2	13278	33.46	3.96	101	435	1.000	0.42	7	0
2005	3	17804	27.47	3.61	107	412	1.000	0.42	7	0
2005	4	20028	25.54	3.55	109	421	1.000	0.42	7	0
2005	5	21832	23.19	3.43	111	452	1.000	0.42	7	0
2005	6	38601	22.51	3.08	119	428	1.000	0.42	7	0
2005	7	18296	25.99	3.25	115	403	1.000	0.42	7	0
2005	8	14549	22.25	3.43	90	378	1.000	0.42	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
2005	9	18189	15.65	3.23	93	352	1.000	0.50	7	0
2005	10	21008	21.20	3.45	89	424	1.000	0.42	7	0
2005	11	18643	15.96	3.34	91	399	1.000	0.50	7	0
2005	12	22692	19.54	3.29	92	391	1.000	0.42	7	0
2005	13	24610	14.60	3.13	95	438	1.000	0.50	7	0
2005	14	15746	28.85	3.67	86	332	1.000	0.42	7	0
2005	15	20301	27.09	3.44	111	262	0.005	0.66	7	0
2005	16	16550	37.53	4.50	93	98	0.016	0.31	7	0
2005	17	21077	30.81	4.11	99	94	0.016	0.31	7	0
2005	18	23301	28.65	4.04	100	95	0.016	0.31	7	0
2005	19	25105	26.02	3.91	102	103	0.016	0.31	7	0
2005	20	22553	17.55	3.68	86	103	0.016	0.31	7	0
2005	21	25372	23.78	3.92	82	124	0.016	0.31	7	0
2005	22	23007	17.89	3.80	84	116	0.016	0.31	7	0
2005	23	17530	5.98	3.57	95	90	0.016	0.00	7	180
2005	24	21088	4.89	3.96	89	90	0.016	0.00	7	180
2005	25	26881	4.21	3.61	94	90	0.016	0.00	7	180
2005	26	27373	4.21	3.25	101	90	0.016	0.00	7	180
2005	27	24892	3.69	3.43	79	90	0.016	0.00	7	180
2005	28	32776	3.24	3.45	78	90	0.016	0.00	7	180
2006	1	14209	37.56	3.53	109	451	1.000	0.42	7	0
2006	2	13342	34.16	3.91	102	444	1.000	0.42	7	0
2006	3	17870	28.01	3.57	108	420	1.000	0.42	7	0
2006	4	20093	25.92	3.52	109	428	1.000	0.42	7	0
2006	5	21895	23.53	3.40	111	459	1.000	0.42	7	0
2006	6	38696	22.84	3.04	120	434	1.000	0.42	7	0
2006	7	18394	26.45	3.21	116	410	1.000	0.42	7	0
2006	8	14590	22.41	3.40	90	381	1.000	0.42	7	0
2006	9	18257	15.86	3.21	93	357	1.000	0.50	7	0
2006	10	21062	21.45	3.42	90	429	1.000	0.42	7	0
2006	11	18719	16.24	3.31	92	406	1.000	0.50	7	0
2006	12	22744	19.75	3.26	93	395	1.000	0.42	7	0
2006	13	24696	14.88	3.10	96	447	1.000	0.50	7	0
2006	14	15800	29.16	3.63	86	335	1.000	0.42	7	0
2006	15	20365	27.47	3.41	111	266	0.005	0.66	7	0
2006	16	16615	38.32	4.45	94	101	0.016	0.31	7	0
2006	17	21142	31.41	4.06	100	95	0.016	0.31	7	0
2006	18	23365	29.07	4.00	101	97	0.016	0.31	7	0
2006	19	25168	26.40	3.87	103	104	0.016	0.31	7	0
2006	20	22621	17.79	3.65	86	104	0.016	0.31	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
2006	21	25426	24.05	3.89	83	125	0.016	0.32	7	0
2006	22	23082	18.22	3.77	84	118	0.016	0.31	7	0
2006	23	18633	6.08	3.53	96	100	0.016	0.00	7	180
2006	24	22428	4.97	3.91	90	100	0.016	0.00	7	180
2006	25	28434	4.27	3.57	95	100	0.016	0.00	7	180
2006	26	28958	4.27	3.21	102	100	0.016	0.00	7	180
2006	27	26631	3.75	3.40	79	100	0.016	0.00	7	180
2006	28	34766	3.29	3.42	79	100	0.016	0.00	7	180
2007	1	14266	38.31	3.50	109	460	1.000	0.42	7	0
2007	2	13401	34.86	3.88	102	453	1.000	0.42	7	0
2007	3	17932	28.57	3.54	109	429	1.000	0.42	7	0
2007	4	20151	26.29	3.49	110	434	1.000	0.42	7	0
2007	5	21955	23.88	3.38	112	466	1.000	0.42	7	0
2007	6	38779	23.15	3.01	121	440	1.000	0.42	7	0
2007	7	18479	26.88	3.18	116	417	1.000	0.42	7	0
2007	8	14632	22.62	3.37	91	385	1.000	0.42	7	0
2007	9	18320	16.05	3.19	94	361	1.000	0.50	7	0
2007	10	21110	21.70	3.39	90	434	1.000	0.42	7	0
2007	11	18785	16.51	3.29	92	413	1.000	0.50	7	0
2007	12	22793	19.99	3.24	93	400	1.000	0.42	7	0
2007	13	24769	15.15	3.08	96	455	1.000	0.50	7	0
2007	14	15860	29.60	3.60	87	340	1.000	0.42	7	0
2007	15	20423	27.88	3.39	112	269	0.005	0.66	7	0
2007	16	16674	39.09	4.41	94	103	0.016	0.31	7	0
2007	17	21204	32.05	4.03	100	97	0.016	0.31	7	0
2007	18	23423	29.48	3.97	101	98	0.016	0.31	7	0
2007	19	25228	26.78	3.84	103	106	0.016	0.31	7	0
2007	20	22683	17.99	3.63	86	105	0.016	0.31	7	0
2007	21	25474	24.34	3.86	83	127	0.016	0.31	7	0
2007	22	23149	18.51	3.74	85	121	0.016	0.31	7	0
2007	23	18595	6.59	3.50	96	110	0.016	0.00	7	180
2007	24	22376	5.38	3.88	90	110	0.016	0.00	7	180
2007	25	28370	4.63	3.54	96	110	0.016	0.00	7	180
2007	26	29930	4.22	3.18	102	120	0.016	0.00	7	180
2007	27	26483	4.08	3.37	80	110	0.016	0.00	7	180
2007	28	34600	3.58	3.39	79	110	0.016	0.00	7	180
2008	1	14322	39.00	3.47	110	468	1.000	0.42	7	0
2008	2	13461	35.56	3.84	103	462	1.000	0.42	7	0
2008	3	17996	29.16	3.51	109	437	1.000	0.42	7	0
2008	4	20206	26.64	3.46	110	440	1.000	0.42	7	0
2008	5	22012	24.23	3.35	112	472	1.000	0.42	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
2008	6	38863	23.45	2.99	122	446	1.000	0.42	7	0
2008	7	18562	27.29	3.15	117	423	1.000	0.42	7	0
2008	8	14676	22.87	3.35	91	389	1.000	0.42	7	0
2008	9	18373	16.21	3.17	94	365	1.000	0.50	7	0
2008	10	21157	21.98	3.37	91	440	1.000	0.42	7	0
2008	11	18839	16.76	3.26	92	419	1.000	0.50	7	0
2008	12	22844	20.25	3.22	93	405	1.000	0.42	7	0
2008	13	24830	15.41	3.05	96	462	1.000	0.50	7	0
2008	14	15927	30.14	3.57	87	347	1.000	0.42	7	0
2008	15	20478	28.26	3.36	112	273	0.005	0.66	7	0
2008	16	16734	39.87	4.37	95	105	0.016	0.31	7	0
2008	17	21268	32.70	3.99	101	99	0.016	0.31	7	0
2008	18	23478	29.88	3.94	102	100	0.016	0.31	7	0
2008	19	25285	27.17	3.81	104	107	0.016	0.31	7	0
2008	20	22737	18.18	3.61	87	106	0.016	0.31	7	0
2008	21	25520	24.65	3.83	83	128	0.016	0.31	7	0
2008	22	23203	18.80	3.71	85	122	0.016	0.31	7	0
2008	23	18626	6.62	3.47	97	110	0.016	0.00	7	180
2008	24	22411	5.40	3.84	91	110	0.016	0.00	7	180
2008	25	28410	4.64	3.51	96	110	0.016	0.00	7	180
2008	26	29986	4.23	3.15	103	120	0.016	0.00	7	180
2008	27	26503	4.09	3.35	80	110	0.016	0.00	7	180
2008	28	34623	3.59	3.37	80	110	0.016	0.00	7	180
2009	1	14383	39.79	3.44	111	477	1.000	0.42	7	0
2009	2	13520	36.25	3.81	104	471	1.000	0.42	7	0
2009	3	18055	29.69	3.48	110	445	1.000	0.42	7	0
2009	4	20259	26.97	3.44	111	445	1.000	0.42	7	0
2009	5	22069	24.58	3.33	113	479	1.000	0.42	7	0
2009	6	38944	23.74	2.96	122	451	1.000	0.42	7	0
2009	7	18643	27.67	3.12	118	429	1.000	0.42	7	0
2009	8	14722	23.13	3.33	91	393	1.000	0.42	7	0
2009	9	18434	16.43	3.15	95	370	1.000	0.50	7	0
2009	10	21203	22.25	3.34	91	445	1.000	0.42	7	0
2009	11	18900	17.01	3.24	93	425	1.000	0.50	7	0
2009	12	22895	20.50	3.19	94	410	1.000	0.42	7	0
2009	13	24893	15.67	3.03	97	470	1.000	0.50	7	0
2009	14	15998	30.88	3.53	88	355	1.000	0.42	7	0
2009	15	20531	28.60	3.33	113	276	0.005	0.66	7	0
2009	16	16793	40.66	4.34	95	107	0.016	0.31	7	0
2009	17	21328	33.30	3.96	101	101	0.016	0.31	7	0
2009	18	23531	30.25	3.91	102	101	0.016	0.31	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
2009	19	25341	27.57	3.78	104	109	0.016	0.31	7	0
2009	20	22798	18.43	3.58	87	108	0.016	0.31	7	0
2009	21	25567	24.95	3.80	84	130	0.016	0.31	7	0
2009	22	23263	19.07	3.69	85	124	0.016	0.31	7	0
2009	23	18663	6.64	3.44	98	110	0.016	0.00	7	180
2009	24	22446	5.41	3.81	92	110	0.016	0.00	7	180
2009	25	28444	4.65	3.48	97	110	0.016	0.00	7	180
2009	26	30041	4.24	3.12	104	120	0.016	0.00	7	180
2009	27	26525	4.09	3.33	80	110	0.016	0.00	7	180
2009	28	34645	3.60	3.34	80	110	0.016	0.00	7	180
2010	1	14429	40.32	3.41	111	484	1.000	0.42	7	0
2010	2	13574	36.86	3.78	104	479	1.000	0.42	7	0
2010	3	18111	30.19	3.45	110	453	1.000	0.42	7	0
2010	4	20311	27.29	3.41	111	450	1.000	0.42	7	0
2010	5	22132	24.99	3.30	114	487	1.000	0.42	7	0
2010	6	39023	24.01	2.94	123	456	1.000	0.42	7	0
2010	7	18720	28.03	3.09	118	434	1.000	0.42	7	0
2010	8	14771	23.44	3.30	92	398	1.000	0.42	7	0
2010	9	18502	16.69	3.13	95	376	1.000	0.50	7	0
2010	10	21256	22.58	3.32	92	452	1.000	0.42	7	0
2010	11	18970	17.31	3.22	93	433	1.000	0.50	7	0
2010	12	22952	20.81	3.17	94	416	1.000	0.42	7	0
2010	13	24966	16.00	3.01	97	480	1.000	0.50	7	0
2010	14	16067	31.64	3.50	88	364	1.000	0.42	7	0
2010	15	20584	28.92	3.30	114	280	0.005	0.66	7	0
2010	16	16847	41.35	4.30	96	109	0.016	0.31	7	0
2010	17	21384	33.87	3.93	102	103	0.016	0.31	7	0
2010	18	23584	30.60	3.88	103	102	0.016	0.31	7	0
2010	19	25405	28.03	3.76	105	110	0.016	0.31	7	0
2010	20	22866	18.73	3.56	87	110	0.016	0.31	7	0
2010	21	25620	25.33	3.77	84	131	0.016	0.31	7	0
2010	22	23334	19.41	3.67	86	126	0.016	0.31	7	0
2010	23	18684	6.66	3.41	98	110	0.016	0.00	7	180
2010	24	22476	5.43	3.78	92	110	0.016	0.00	7	180
2010	25	28476	4.66	3.45	97	110	0.016	0.00	7	180
2010	26	30091	4.25	3.09	104	120	0.016	0.00	7	180
2010	27	26549	4.10	3.30	81	110	0.016	0.00	7	180
2010	28	34674	3.60	3.32	81	110	0.016	0.00	7	180
2011	1	14476	40.86	3.38	112	490	1.000	0.42	7	0
2011	2	13628	37.48	3.75	105	487	1.000	0.42	7	0
2011	3	18167	30.70	3.43	111	461	1.000	0.42	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
2011	4	20366	27.63	3.39	112	456	1.000	0.42	7	0
2011	5	22196	25.41	3.28	114	495	1.000	0.42	7	0
2011	6	39103	24.28	2.91	124	461	1.000	0.42	7	0
2011	7	18799	28.40	3.06	119	440	1.000	0.42	7	0
2011	8	14819	23.72	3.28	92	403	1.000	0.42	7	0
2011	9	18567	16.95	3.11	95	381	1.000	0.50	7	0
2011	10	21306	22.89	3.29	92	458	1.000	0.42	7	0
2011	11	19038	17.59	3.20	94	440	1.000	0.50	7	0
2011	12	23006	21.10	3.15	95	422	1.000	0.42	7	0
2011	13	25036	16.28	2.99	98	488	1.000	0.50	7	0
2011	14	16136	32.39	3.47	89	372	1.000	0.42	7	0
2011	15	20638	29.28	3.28	114	283	0.005	0.66	7	0
2011	16	16901	42.04	4.26	96	110	0.016	0.66	7	0
2011	17	21440	34.43	3.90	102	104	0.016	0.31	7	0
2011	18	23638	30.99	3.85	103	103	0.016	0.31	7	0
2011	19	25469	28.49	3.73	105	112	0.016	0.31	7	0
2011	20	22931	19.00	3.54	88	111	0.016	0.31	7	0
2011	21	25669	25.67	3.75	85	133	0.016	0.31	7	0
2011	22	23401	19.72	3.64	86	128	0.016	0.31	7	0
2011	23	18707	6.68	3.38	99	110	0.016	0.00	7	180
2011	24	22505	5.44	3.75	92	110	0.016	0.00	7	180
2011	25	28508	4.67	3.43	98	110	0.016	0.00	7	180
2011	26	30143	4.26	3.06	105	120	0.016	0.00	7	180
2011	27	26573	4.11	3.28	81	110	0.016	0.00	7	180
2011	28	34699	3.61	3.29	81	110	0.016	0.00	7	180
2012	1	14523	41.41	3.36	112	497	1.000	0.42	7	0
2012	2	13676	38.01	3.72	105	494	1.000	0.42	7	0
2012	3	18215	31.09	3.40	112	466	1.000	0.42	7	0
2012	4	20406	27.80	3.36	112	459	1.000	0.42	7	0
2012	5	22237	25.57	3.25	115	499	1.000	0.42	7	0
2012	6	39167	24.42	2.89	124	464	1.000	0.42	7	0
2012	7	18866	28.65	3.04	120	444	1.000	0.42	7	0
2012	8	14866	24.01	3.26	93	408	1.000	0.42	7	0
2012	9	18630	17.18	3.09	96	387	1.000	0.50	7	0
2012	10	21355	23.19	3.27	92	464	1.000	0.42	7	0
2012	11	19100	17.83	3.18	94	446	1.000	0.50	7	0
2012	12	23058	21.38	3.13	95	428	1.000	0.42	7	0
2012	13	25106	16.52	2.97	98	496	1.000	0.50	7	0
2012	14	16201	33.10	3.44	89	381	1.000	0.42	7	0
2012	15	20679	29.47	3.26	115	285	0.005	0.66	7	0
2012	16	16949	42.64	4.23	97	112	0.016	0.31	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
2012	17	21487	34.87	3.87	103	106	0.016	0.31	7	0
2012	18	23679	31.18	3.83	103	104	0.016	0.31	7	0
2012	19	25510	28.68	3.70	105	113	0.016	0.31	7	0
2012	20	22994	19.27	3.52	88	113	0.016	0.31	7	0
2012	21	25718	26.01	3.72	85	135	0.016	0.31	7	0
2012	22	23463	19.99	3.62	87	130	0.016	0.31	7	0
2012	23	18730	6.71	3.36	99	110	0.016	0.00	7	180
2012	24	22529	5.46	3.72	92	110	0.016	0.00	7	180
2012	25	28531	4.68	3.40	99	110	0.016	0.00	7	180
2012	26	30183	4.27	3.04	106	120	0.016	0.00	7	180
2012	27	26596	4.12	3.26	82	110	0.016	0.00	7	180
2012	28	34724	3.61	3.27	81	110	0.016	0.00	7	180
2013	1	14576	42.13	3.33	113	506	1.000	0.42	7	0
2013	2	13729	38.65	3.69	106	502	1.000	0.42	7	0
2013	3	18267	31.57	3.37	112	474	1.000	0.42	7	0
2013	4	20449	28.03	3.34	113	462	1.000	0.42	7	0
2013	5	22278	25.73	3.23	115	502	1.000	0.42	7	0
2013	6	39239	24.65	2.87	125	468	1.000	0.42	7	0
2013	7	18938	28.96	3.01	120	449	1.000	0.42	7	0
2013	8	14913	24.30	3.24	93	413	1.000	0.42	7	0
2013	9	18691	17.41	3.07	96	392	1.000	0.50	7	0
2013	10	21403	23.49	3.25	93	470	1.000	0.42	7	0
2013	11	19160	18.06	3.16	94	451	1.000	0.50	7	0
2013	12	23109	21.64	3.10	95	433	1.000	0.42	7	0
2013	13	25173	16.75	2.95	99	503	1.000	0.50	7	0
2013	14	16269	33.89	3.41	90	390	1.000	0.42	7	0
2013	15	20722	29.71	3.24	115	287	0.005	0.66	7	0
2013	16	17001	43.35	4.19	97	114	0.016	0.31	7	0
2013	17	21540	35.41	3.84	103	107	0.016	0.31	7	0
2013	18	23722	31.44	3.80	104	105	0.016	0.31	7	0
2013	19	25551	28.86	3.68	106	114	0.016	0.31	7	0
2013	20	23054	19.52	3.49	89	114	0.016	0.31	7	0
2013	21	25766	26.34	3.69	85	137	0.016	0.31	7	0
2013	22	23524	20.26	3.60	87	131	0.016	0.31	7	0
2013	23	18758	6.73	3.33	99	110	0.016	0.00	7	180
2013	24	22558	5.47	3.69	93	110	0.016	0.00	7	180
2013	25	28559	4.70	3.37	99	110	0.016	0.00	7	180
2013	26	30229	4.28	3.01	106	120	0.016	0.00	7	180
2013	27	26619	4.13	3.24	82	110	0.016	0.00	7	180
2013	28	34748	3.62	3.25	82	110	0.016	0.00	7	180
2014	1	14621	42.62	3.30	114	511	1.000	0.42	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
2014	2	13774	39.11	3.66	106	508	1.000	0.42	7	0
2014	3	18316	31.98	3.35	113	480	1.000	0.42	7	0
2014	4	20491	28.24	3.32	113	466	1.000	0.42	7	0
2014	5	22317	25.88	3.21	115	505	1.000	0.42	7	0
2014	6	39306	24.85	2.84	126	472	1.000	0.42	7	0
2014	7	19006	29.23	2.98	121	453	1.000	0.42	7	0
2014	8	14958	24.57	3.21	93	418	1.000	0.42	7	0
2014	9	18751	17.64	3.05	96	397	1.000	0.50	7	0
2014	10	21447	23.75	3.22	93	475	1.000	0.42	7	0
2014	11	19220	18.29	3.14	95	457	1.000	0.50	7	0
2014	12	23157	21.89	3.08	96	438	1.000	0.42	7	0
2014	13	25240	16.99	2.93	99	510	1.000	0.50	7	0
2014	14	16334	34.63	3.38	90	398	1.000	0.42	7	0
2014	15	20764	29.93	3.22	116	289	0.005	0.66	7	0
2014	16	17047	43.86	4.16	98	115	0.016	0.31	7	0
2014	17	21589	35.88	3.81	104	109	0.016	0.31	7	0
2014	18	23764	31.67	3.78	104	106	0.016	0.31	7	0
2014	19	25590	29.03	3.66	106	115	0.016	0.31	7	0
2014	20	23114	19.78	3.47	89	116	0.016	0.31	7	0
2014	21	25811	26.64	3.67	86	139	0.016	0.31	7	0
2014	22	23584	20.51	3.58	87	133	0.016	0.31	7	0
2014	23	18779	6.75	3.30	100	110	0.016	0.00	7	180
2014	24	22578	5.49	3.66	93	110	0.016	0.00	7	180
2014	25	28583	4.71	3.35	99	110	0.016	0.00	7	180
2014	26	30270	4.29	2.98	106	120	0.016	0.00	7	180
2014	27	26639	4.14	3.21	82	110	0.016	0.00	7	180
2014	28	34767	3.63	3.22	82	110	0.016	0.00	7	180
2015	1	14669	43.16	3.28	114	518	1.000	0.42	7	0
2015	2	13823	39.64	3.63	107	515	1.000	0.42	7	0
2015	3	18367	32.44	3.32	113	487	1.000	0.42	7	0
2015	4	20534	28.47	3.30	114	470	1.000	0.42	7	0
2015	5	22355	26.02	3.19	116	507	1.000	0.42	7	0
2015	6	39376	25.07	2.82	126	476	1.000	0.42	7	0
2015	7	19077	29.54	2.96	122	458	1.000	0.42	7	0
2015	8	15003	24.85	3.19	94	422	1.000	0.42	7	0
2015	9	18813	17.88	3.03	97	402	1.000	0.50	7	0
2015	10	21493	24.03	3.20	94	481	1.000	0.42	7	0
2015	11	19282	18.54	3.12	95	464	1.000	0.50	7	0
2015	12	23206	22.14	3.06	96	443	1.000	0.42	7	0
2015	13	25308	17.24	2.92	99	517	1.000	0.50	7	0
2015	14	16396	35.35	3.35	91	407	1.000	0.42	7	0

Columns: **1** = model year; **2** = vehicle class; **3** = purchase price when new (1995$); **4** = miles per gasoline equivalent gallon for classes 1-22, miles per KWH for classes 23-28; **5** = acceleration from 0-30 mph; **6** = top speed in mph; **7** = range in miles for a full fuel tank or full charge; **8** = service station fuel availability (gasoline = 1.000); **9** = tailpipe emissions (1993 and earlier gasoline vehicles = 1.00); **10** = service station refuel or recharge time in minutes; **11** = home recharge time in minutes.

1	2	3	4	5	6	7	8	9	10	11
2015	15	20807	30.19	3.20	116	292	0.005	0.66	7	0
2015	16	17096	44.46	4.13	98	117	0.016	0.31	7	0
2015	17	21640	36.39	3.78	104	110	0.016	0.31	7	0
2015	18	23807	31.92	3.75	105	107	0.016	0.31	7	0
2015	19	25627	29.18	3.63	107	115	0.016	0.31	7	0
2015	20	23176	20.06	3.45	89	118	0.016	0.31	7	0
2015	21	25857	26.95	3.64	86	140	0.016	0.31	7	0
2015	22	23645	20.80	3.55	88	135	0.016	0.31	7	0
2015	23	18803	6.77	3.28	100	110	0.016	0.00	7	180
2015	24	22603	5.50	3.63	94	110	0.016	0.00	7	180
2015	25	28610	4.72	3.32	99	110	0.016	0.00	7	180
2015	26	30715	4.15	2.96	107	120	0.016	0.00	7	180
2015	27	26660	4.15	3.19	83	110	0.016	0.00	7	180
2015	28	34789	3.63	3.20	83	110	0.016	0.00	7	180

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